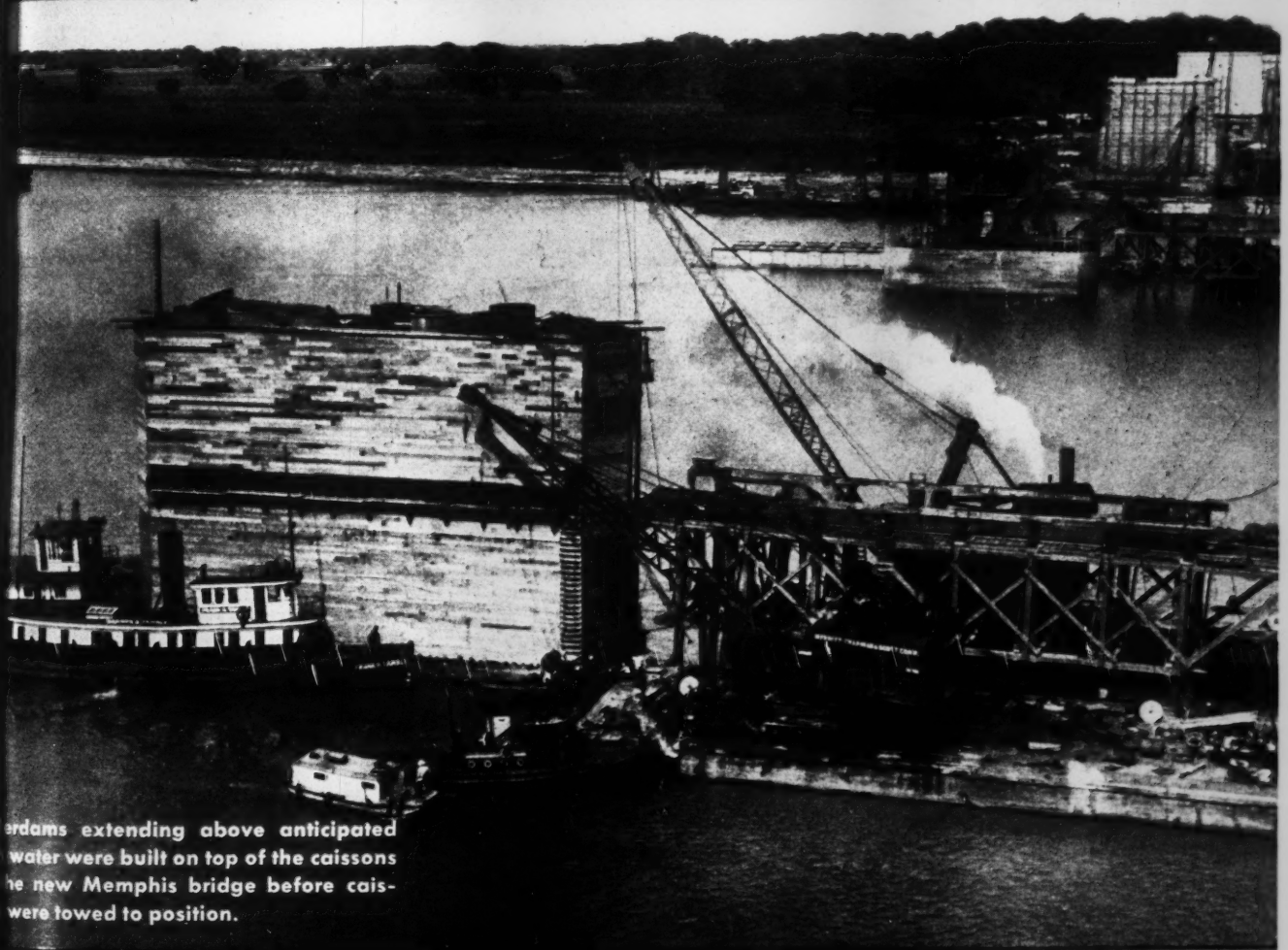
ENGINEERING NEWS-RECORD

A McGRAW-HILL PUBLICATION

MARCH 20, 1947



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VENEZUELA BUILDS ROADS TO RICHES

CANALS ARE NEXT ON CENTRAL VALLEY

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Volume 138 • Number 12 March 20, 1947

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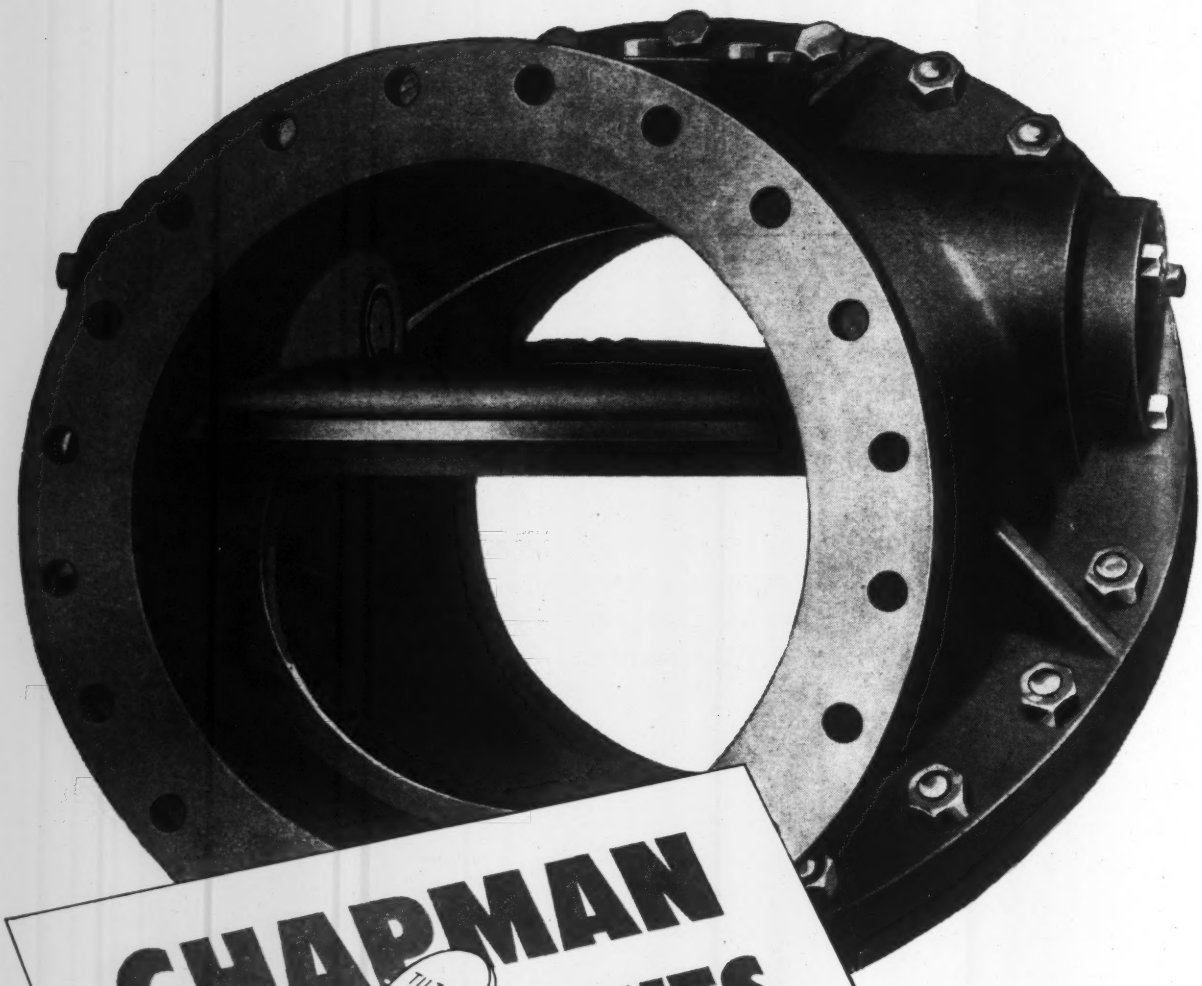

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Construction Trends

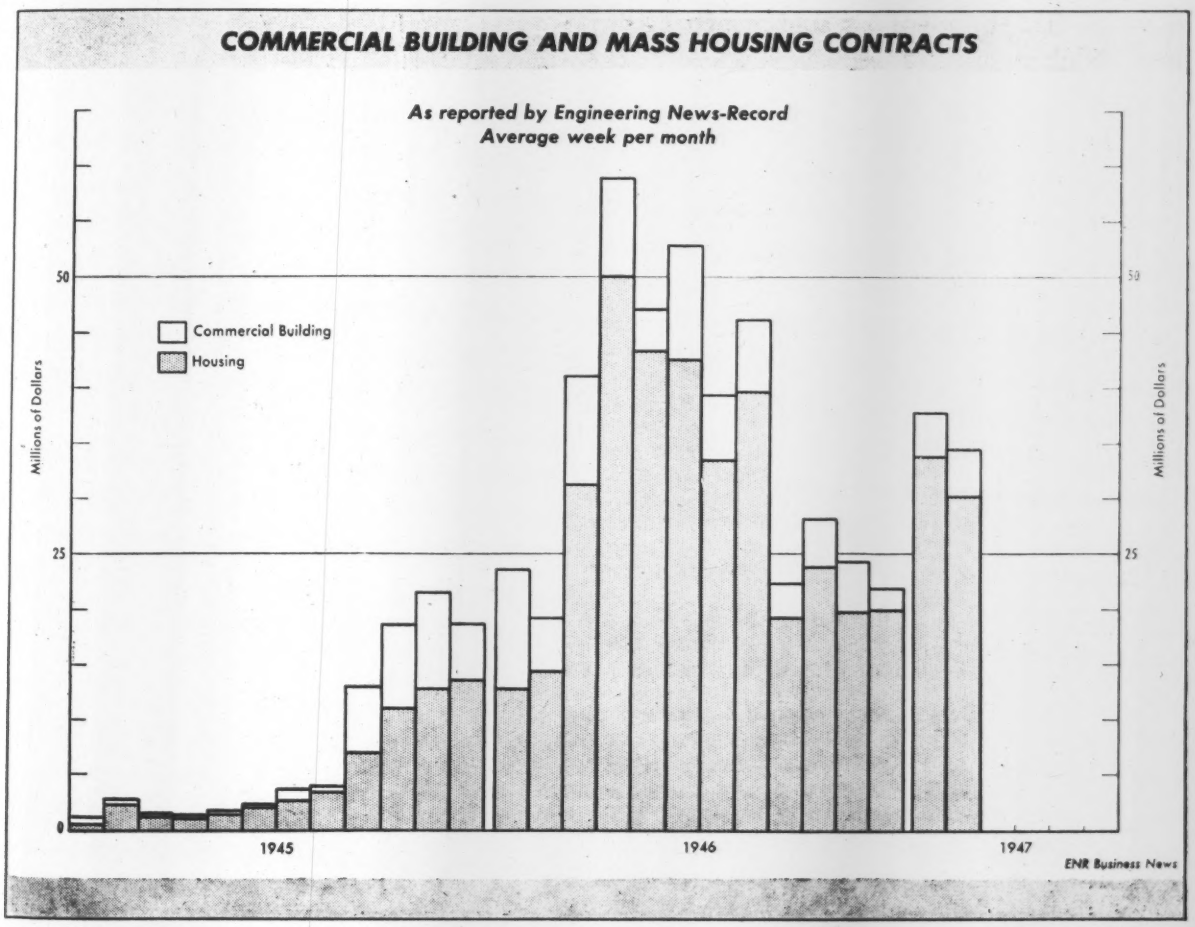
Mass Housing Double a Year Ago

New commercial building contracts awarded during the first ten weeks of this year support the expectation of another record year for 1947. As reported by *Engineering News-Record*, commercial building contracts, totaling $350,834,000 during this period, are 56 percent greater than the cumulative total of $225,014,000 for the corresponding period of 1946.

The rise over a year ago in the value of commercial building contracts is accounted for entirely by the rise in housing. Mass housing contracts awarded in the first ten weeks of 1947 more than doubled in value compared with the same period of 1946, rising to $311,773,000 from $140,781,000 a year ago, an increase of 121 percent. Other commercial building contracts awarded dropped 54 percent to $39,061,000 from $84,233,000 in the same period last year.

Weekly averages per month for commercial building contracts awarded during January and February of 1947 are running $13,913,000 and $15,245,000, respectively, ahead of a year ago. The February, 1947 weekly average of $34,540,000, although 8 percent below the previous month, showed a gain of 79 percent over the February, 1946 average of $19,295,000. The January, 1947 average of $37,553,000 showed a rise of 59 percent over the January, 1947 average. Weekly contracts awarded for the first month of last year averaged $23,640,000.

Of the total value of commercial building contracts awarded so far this year, 89 percent are mass housing contracts. The remaining 11 percent include contracts for such building projects as hospitals, clubs, banks, offices, theatres, stores, private schools and colleges, and churches. In the same period of 1946, mass housing accounted for 63 percent of the total value of commercial building, and other building accounted for 37 percent of the total.



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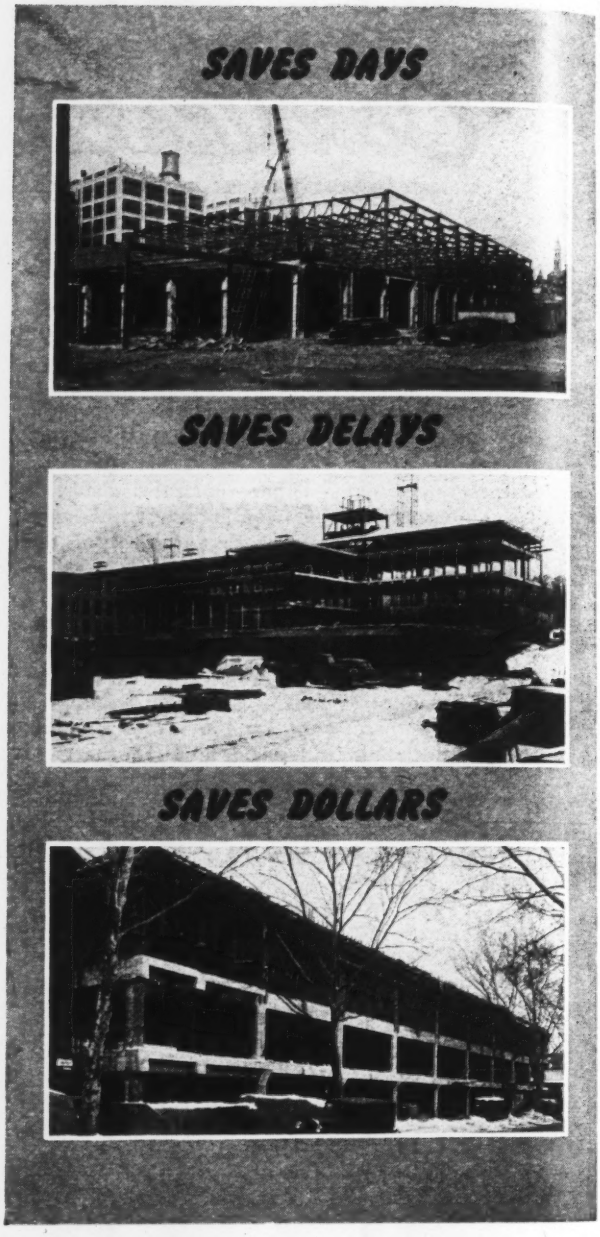

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News of the Week

ENGINEERING NEWS-RECORD • MARCH 20, 1947 • VOLUME 138 • NUMBER 12

Reclamation Bureau plan calls for $5.6 billion work

Long-range program has 238 projects in Columbia Basin and Pacific Northwest, includes irrigation and power production—States asked to approve scheme

A long-range program for the development of the water and power resources of the Pacific Northwest that will involve the expenditure of more than $5,600,000,000 over a period of years, was approved by the Bureau of Reclamation last week.

The cost estimate, according to Secretary of the Interior J. A. Krug, was based on admittedly high costs of 1946. The general program has been submitted for comment to officials of seven states in whose jurisdiction the projects would fall, and it may be some time before Congress receives the plan.

Result of conferences among nine federal agencies involved, the plan would call for the construction or completion of 238 specific projects and ultimately would benefit 5,360,000 acres of potential farmland and produce a five-fold increase of hydroelectric capacity in the area. The problems of flood control, navigation improvements, fish and wildlife conservation, and pollution abatement are considered in the general program.

Of the 238 projects, eleven are singled out for immediate attention to meet needs of the region. These include work on the Payette unit of the Mountain Home project in Idaho; the Bitterroot Valley project in Montana; projects on the Crooked River in Oregon; the Yakima project in Washington, and the Upper Star Valley project in Western Wyoming. The total cost of this work is estimated at $179,000,000, of which irrigators are expected to return $27,714,000 and power users $143,160,000. The remaining $8,000,000 of the cost is expected to be allocated to flood control and wildlife conservation.

These projects are expected to bring 273,000 additional acres of land under irrigation, provide supplemental water for 53,000 acres and make available 177,000 kw. of new hydroelectric power capacity for the region.

Other projects covered

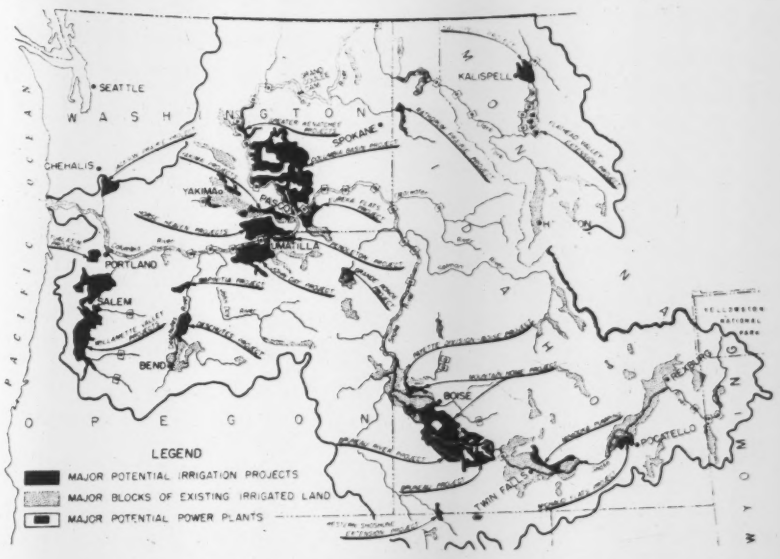
Michael W. Straus, Commissioner of Reclamation, said that the report covers some 47 projects in the Columbia Basin now authorized for construction but not yet under way by the Bureau of Reclamation, the Office of Indian Affairs or the War Department. Further appropriations to initiate or continue and complete these projects will be recommended as construction schedules are completed.

Other features of the program, according to the Reclamation Bureau announcement, would include flood protection—provided by bureau and Army Engineer works for nearly 1,500,000 acres, and drainage projects to improve the utility of 500,000 additional acres; improvement of slack water navigation on the lower Columbia, Willamette and Snake rivers to Wenatchee, Wash., and Lewiston, Idaho; and "material reduction" of stream pollution on the Willamette River and its many tributary streams.

Repayment plan

About 84 percent of the total construction cost would be returned to the federal government through repayments by water users and from power revenues. The return to the Treasury of costs chargeable to power, irrigation and potable water would be assured by a financial pooling arrangement which would treat the entire basin as a unit, Mr. Krug said. A single account for the entire basin is recommended, and under this arrangement, construction costs for irrigation and power would be charged to that account.

Even with present high construction costs, Mr. Krug added, a surplus of revenue over the total cost of all projects is in prospect.



***Comprehensive Plan**—Long-range development of some 238 water and power projects in the Columbia River Basin is envisaged in departmental plan revealed by the Bureau of Reclamation.*

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public construction—The State College of Washington, at *Pullman*, has awarded a $1,926,999 contract for a 4-story classroom building. . . . A $20,000,000 expansion of port facilities at *Seattle, Wash.*, has been proposed by General Manager W. G. Lamport. . . . A $1,000,000 science building and a $500,000 field house will be built at Brigham Young University, *Provo, Utah* . . . A school bond issue of $1,500,000 has been approved at *Palm Springs, Calif.* . . . Civil Aeronautics Administration will seek bids soon for a $565,000 airport at *Winder, Ga.* . . . *La Grange, Ga.*, has selected engineers to prepare plans for a $1,500,000 natural gas system. . . . *Hoganville, Ga.*, has asked engineers to prepare plans for a similar project to cost $500,000. . . . *Pennsylvania* Department of Welfare will build a psychiatric institute to cost $6,000,000.

Industrial construction—Sunshine Biscuit Co., will erect a $990,000 building in *Kansas City, Kan.* . . . Meyer's Department Store will soon build a $1,000,000 addition at *Greensboro, N. C.* . . . Development of a $2,000,000 mooring basin at Bay View Park near *Toledo, Ohio*, has been recommended. . . . Contracts have been awarded to Wermuth, Inc., for a 3-story addition to the U. S. Rubber Co. plant east of *Fort Wayne, Ind.*, and for remodeling and equipping of the main plant. . . . Indiana Bell Telephone Co., *Indianapolis, Ind.*, has state-wide expansion plans to cost $50,000,000 of which $5,000,000 will be spent in the next three years.

Highways—Berlanti Construction Co. was low bidder at $978,088 for bridges, grading and pavement work in *Delaware County* for the Pennsylvania State Highway Department. . . . *Massachusetts* State Outdoor Advertising Authority has ruled that no new billboards may be erected in open country or residential areas. . . . *Syracuse, N. Y.*, has approved repaving of five principal streets at a cost of $491,000. . . . A bill has been introduced in the *Maine* assembly to appropriate $220,000 for enlargement or reconstruction of the U. S. end of the international bridge over St. Croix River, connecting *Calais, Me.* and *St. Stephen, N. B.* The work would be contingent on enlargement or reconstruction by Canada of its end of the bridge. . . . The Indiana Senate killed the $27,000,000 *Fort Wayne* super-highway bill, by indefinite postponement. The measure cannot be brought up again until the 1949 session of the Legislature.

Housing—Approved Trenton Homes, Inc., is starting work on a 102-home project at *Trenton, N. J.* . . . Precision Homes Co., *Stockton, Calif.*, has plans for a $1,500,000 plant to build homes by a modular panel system, prices to range from $5,000 to $11,000. . . . Plans for construction of 350 houses at *Coos Bay, Ore.*, at an estimated cost of $2,450,000 have been announced by the Portland, Ore., firm of Carroll, Hillman & Hedlund. . . . Stephen Schifter, Inc., Haverton, Pa., has started a $1,000,000 residential development at *Bryn Mawr Farms, Pa.* . . . Fairlamb Construction Corp., Upper Darby, Pa. got an FHA approval for 298 additional homes in *Overbrook Park, Pa.*, to cost nearly $3,000,000. . . . Mt. Airy Construction Co., *Philadelphia, Pa.*, has under way residential and apartment developments to cost $1,500,000.

Water supply and sewers—*Durham, N. C.*, has been granted FWA funds for plan preparation for water and sewer improvements to cost $3,731,950. . . . Rising costs may delay the large sewage disposal project at *South Bend, Ind.* . . . Plans are announced for a $3,500,000 sewer system in the suburban Lake City district of *Seattle, Wash.* . . . Plans are considered at *Valdosta, Ga.*, for water and sewer extensions to cost $1,500,000. . . . *Miami Beach, Fla.*, will vote April 8 on a $1,644,000 bond issue of which $500,000 would be for sewer and water work. . . . Waterworks changes and additions at *Merchantville-Pennsauken, N. J.*, will cost $200,000. . . . *Delaware, Ohio*, has authorized $100,000 bonds for main extension.

$175 million road programs planned

Highway construction programs totalling more than $175,000,000 were announced in three states last week as highway departments prepared for the imminent opening of the construction season.

Governor William Preston Lane of Maryland in a message to the state legislature, proposed a program of improvements to be financed in part by a $100,000,000 highway bond issue, increased automobile and gasoline taxes, and tolls. Included were:

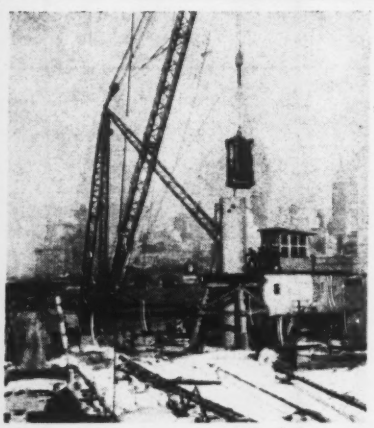
Building of the long-proposed Chesapeake Bay bridge; construction of a tunnel under, or a bridge over, Baltimore harbor; construction of high-speed toll expressways, and construction and maintenance of streets and highways in the city of Baltimore and the counties of the State.

"In addition to the new Chesapeake Bay Bridge" said the governor, "there is the Patapsco River Bridge, or tunnel, to be built before the primary program of crossings is completed.

The Florida state road department has adopted its 1947 operating budget of $65,000,000, which includes nearly $54,000,000 worth of road and bridge construction. The budget is the largest in the history of the department.

The Wisconsin state highway commission has a construction program estimated to cost $20,542,000 which will include about 180 projects, according to an announcement made by E. L. Roettiger, Madison, state highway engineer to a meeting of the Wisconsin Road Builders' association held in Milwaukee.

Of the total, 108 projects call for state highway construction to cost $16,237,000, about 55 for secondary road jobs costing $2,973,000, and 11 for urban improvements costing $1,332,000.



***Ventilation Building**—Pipe caissons of 5 ft. 6 in. diameter are driven 70 ft. through mixed materials to support a ventilator building offshore from Gove nor's Island in New York harbor, for New York's Brooklyn-Battery tunnel. A heavy hammer drives through a thick steel plate to distribute the blow around the shell, while a jet loosens material at cutting edge. Construction is being done by the Grow Construction Co., New York, for the Triborough Bridge and Tunnel Authority.*

Delaware anti-pollution work starts

A 4-state pollution abatement program for the Delaware River Basin will begin March 25 with receipt of bids for the projected Northeast sewage treatment plant for Philadelphia, Pa.

Other projects totalling about $100,000,000 in cost will include desilting basins, dredging operations, dams, silt disposal areas, municipal and industrial waste treatment plants and other units in Pennsylvania, New York, New Jersey and Delaware.

Bids on the Philadelphia project will mark the first concrete action looking toward construction of works, after more than 10 years of studies made by "Incodel"—the Interstate Commission on the Delaware River Basin for the abatement and control of river pollution. The action will be followed up shortly by other municipalities in the Philadelphia area, where some 35 towns including Camden, Gloucester and Riverton, N. J., are said to be ready to start construction of sewage disposal facilities.

A recently-approved "Incodel" schedule envisages completion of Philadelphia's project by 1951. Other cities between Port Jervis, N. Y., and Wilmington, Del., will be urged to build pollution control plants before 1950.

Announcement of action on the plan came during sessions of the Philadelphia section of the ASCE, when James H. Allen, "Incodel" executive director, told the group that the program is of vital importance in stimulating the uses of the Delaware River as a port.

"These improvements," Mr. Allen said, "will enhance the usefulness of the waters of the region for industrial water supplies, the restoration of shad and other fish life, recreation, the lower bay oyster industry, and many other purposes. It will permit Philadelphia to continue to use the Delaware as a safe and satisfactory source of municipal water supply as long as its officials deem that course to be advisable".

Representing Pennsylvania's Bureau of Forests and Waters as consulting engineer, Frederic H. Dechant told of its cooperation in the work. Essential properties must be appraised and purchased; surveys must be made; and detailed designs and plans must be drawn. In-so-far as possible private consulting engineers are being retained to handle these various sub-projects.

To intercept silt at the headwaters, two large desilting basins are being designed. Pilot-plant studies will provide the basis for these installations.

The past accomplishments and future plans of the Lehigh Navigation Coal Co. in connection with pollution abatement activities in the Schuylkill River basin were outlined by Evan Evans, vice-president and general manager. To date this organization has spent $750,000 for reclamation works, and plans call for an additional expenditure of $500,000 "as soon as conditions in the coal market become favorable."

Wilmington takes action

The appointment of a 5-man advisory committee to aid a proposed $4,500,000 sewage collection and disposal project for Wilmington, Del., as part of the pollution control program in the Delaware basin was announced March 11.

Lowered water table troubles Illinois area

The Illinois Water Service Co. has reported to the Champaign, Ill., city commission, that because of the 50-ft. drop of the water level in the Champaign-Urbana, and University of Illinois area since 1900, the company will require that all refrigeration and airconditioning units carry water reclaiming devices before they can be placed in operation.

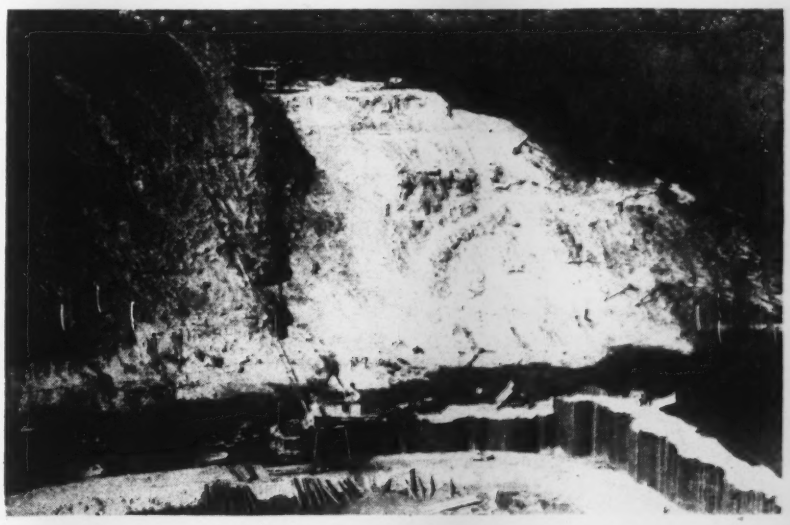
The pumpage in the area has lowered the water level so much that the water company must sink five new wells.

Longest tunnel on C & O line nears completion

Boring of the Chesapeake and Ohio Railway's newest and longest double track tunnel, being constructed on its main lines at Fort Spring, W. Va., has been completed after nearly a year's work. The new tunnel approximately 2,700 ft. long from portal to portal, was driven from both ends through limestone containing clay seams.

The improvement, including relocation of tracks extending beyond the tunnel, totals 1.09 mi. and shortens the C & O main lines by 3,600 ft. It reduces a 303-degree curvature, obviates a 35-mi. slow order at that point and is expected to result in a saving of $80,000 a year in operating expenses.

Work was begun at the west portal on March 26, 1946, and at the east portal June 1, 1946. Steel ribs to support the tunnel roofs were placed as the excavation progressed. To move the solid rock, about 135 holes were drilled to a depth of 15 ft. and shot every 24-hour cycle. Each blast advanced the tunnel approximately 12 ft. After the final blast, March 5, work was started on the concrete lining of the completed tunnel section. The tunnel will have a maximum width of 32 ft. maximum height of 26 ft. 6 in. above the top of the rails. It is expected that traffic will be routed through the new tunnel for the first time about Sept. 1.



Allatoona Dam Progress—*Part of the 40-ft. cellular pile type cofferdam for the $20,000,000 Allatoona Dam in Georgia is already in place, as workers proceed with excavation on the north bank of the Etowah River for abutments for the structure. The hill at top, left, will be site for the concrete mixing plant, where all concrete will be prepared for delivery to a cableway system spanning the site. The $20,000,000 flood control—hydroelectric development is under contract to National Constructors, Inc.*

Canada to repair 2,600 houses for veterans

Between $500,000 and $700,000 must be spent by the government of Canada in carrying out a major repair job on 2,600 veterans' houses built throughout the dominion and found defective, according to a statement made in the Canadian House of Commons recently by Ian Mackenzie, Minister of Veterans Affairs in the federal cabinet.

Rejecting opposition pleas for the setting up of a royal commission to inquire into the widespread defects, Minister Mackenzie said that a special committee of inquiry consisting of the Deputy Minister for Veterans' Affairs, the Director of the Veterans Housing Program, and a Montreal engineer, was now visiting the various housing developments where the faults had developed.

Much of the trouble has been in connection with the drainage of basements and with basement walls. All the conditions can be remedied and, with few exceptions, at a very small cost, Mr. Mackenzie said. The houses have been built during the last year or two under the direction of the Department of Veterans Affairs, this being the only housing venture of the dominion government which is not under the control of the reconstruction minister's office.

E. L. Schmidt takes post as Penna. road engineer

E. L. Schmidt of Pittsburgh on March 1 succeeded to the post of Chief Engineer of the Pennsylvania Department of Highways, following the resignation of T. C. Frame (*ENR* Jan. 30, vol. p. 176).

Mr. Schmidt has been with the department since February, 1939, when he was made district engineer in charge of the Pittsburgh office. Previously he had 23 years service in an engineering capacity for Allegheny County.

J. Paul Ambler succeeds Schmidt as district engineer for the department at Pittsburgh, moving from his immediate past post at Hollidaysburg.

Moving into Ambler's position as district engineer at Hollidaysburg will be William E. Bailey, assigned to the Philadelphia district since 1939. Associated with the Highway Department since 1907, he was assigned district engineer in 1923 and has held posts at Williamsport, Clearfield and Harrisburg.

URGE END OF SUBSIDIES FOR BUILDING MATERIALS

Return to the U. S. treasury of $360,000,000 in unexpended funds appropriated for subsidies to building product manufacturers as a means of aiding efforts to balance the federal budget was urged last week.

Appearing before the House Appropriations Committee, Douglas Whitlock, chairman of the Building Products Institute, said that of $400,000,000 earmarked by Congress for such subsidies, not more than $40,000,000 will have been spent by June 30, 1947.

"Although the funds were made available . . . over the protests of the building industry," Mr. Whitlock said, "it is significant that less than $10,000,000 had been used by the end of 1946—nine months after the money was appropriated. Only 10 premium payment plans were ever put into effect, and all but four of these already have been terminated without any semblance of protest from the industry."

Univ. of Tennessee asks millions for buildings

A total of $15,000,000 is being asked for new buildings at the University of Tennessee, in Knoxville, Martin, and Memphis, according to Acting President C. E. Brehm, who has submitted the recommendations to the State Legislature now in session.

Of this sum, $12,000,000 would have to come from a special bond issue and $3,000,000 from a proposed 2% sales tax levy.

Begin work to form new national building group

Seeking the formation of a National Building Congress to coordinate the efforts of local organizations, an informal committee was at work at Washington, D. C., last week.

Formation of the committee was an outgrowth of a joint meeting called by the Washington Building Congress that attracted representatives of similar organizations from New York City, Boston, Mass.; Philadelphia, Pa.; Baltimore, Md.; Columbus, Ohio; Chicago, Ill.; Indianapolis, Ind.; and Norfolk, Va.

William S. Parker, of Boston, was named chairman of the temporary committee, which was charged with the duty of investigating the "need and feasibility of a National Building Congress" organization.

Cut 1947 housing goal to 825,000 new units

Predicting that no more than 825,000 new homes can be started in 1947 if federal controls and financial aids are continued—and 750,000 if they are dropped—a report prepared by the staff of Housing Expediter Frank R. Creedon recommends that the government aids be continued.

Many officials previously had estimated the number of starts at 1,000,000, this total including temporary and permanent construction and alterations. The predicted decrease is attributed to continued material shortages, relaxation of controls and other restrictions and increased costs.

Sand and gravel industry catching up with demand

President Richard N. Coolidge of the National Sand and Gravel Association, addressing delegates to a national convention in Los Angeles last week, predicted that in the coming year, the industry would catch up with accumulated demand.

Some 600 delegates attended concurrent conventions of the SGA and the Ready Mixed Concrete Association, representing the United States, New Zealand, Hawaii and British Columbia.

The SGA president characterized 1946 as a "year of progress in our economy, climaxed by many substantial advances toward restoration of free enterprise as the basic principle of American business."

"With the advent of 1947," he added, "we are still in the stage of catching up with accumulated demand. And we have the capacity and the manpower to supply it."

Mr. Coolidge, of the Cumberland River Sand Co., Nashville, Tenn., was reelected president of SGA, as were T. E. Popplewell, Ft. Worth San & Gravel Co., Ft. Worth, Tex., vice-president, and H. N. Snyder, Buffalo Slag Co., Buffalo, N. Y., secretary-treasurer.

New officers elected by the Ready Mixed Concrete Association were Frank P. Spratlen, Jr., Ready Mixed Concrete Co., Denver, Colo., president; C. Gray, Ready Mixed Concrete Corp., Indianapolis, Ind., vice-president, and Robert F. Porter, Harry T. Campbell Sons Corp., Towson, Md., secretary-treasurer.

The associations will hold conventions jointly next year in Cincinnati, Ohio, in the latter part of January.

Construction wage demands continue

Strike notice filed at Cleveland, and Akron strike continues—Indianapolis contractors bidding for workmen

General unrest and continued demands for higher pay continued to hold the center of the construction labor scene last week, according to reports to *Engineering News-Record*.

At Akron, Ohio, a 16-day-old strike of 350 plumbers continued, with some 500 painters, paperhangers, glaziers and decorators joining in a demand for more pay. Plumbers have asked a 15 cent per hour raise, to bring their hourly wages to $1.60. Painters demanded $1.90 per hour and glaziers $2.00 per hour.

Cleveland, Ohio, building crafts unions filed 30-day strike notices to back up their demands for wage increases and an employer-financed health and welfare fund.

Reports from Indianapolis, Ind., indicated that some local contractors are attempting to outbid each other for labor by offering overtime pay. The builder of one housing project, according to the reports offered five nine-hour days to workers. A week later, another builder capped the offer by offering five nine-hour and one six-hour day.

In New York City, the Long Island Home Builders' Institute called attention to a sharp decline in home construction in suburban New York areas, blaming increasing pay demands of labor for a drop from 3,000 homes under way at this time in 1946 to about 500 in 1947.

And in Jefferson City, Mo., the state legislature began hearings on a number of pending bills that would prohibit jurisdictional strikes and other labor abuses.

Some settlements

Meanwhile, two disputes over wages were reported settled. At Toledo, Ohio, a joint conference board of the Toledo Building Congress approved wage increases of between 5 and 12½ percent for about 15,000 building trades workers, in a move to equalize Toledo rates with those paid in Detroit and Cleveland.

The board recommended, additionally, that "as much overtime as possible" be eliminated, and the inauguration of an educational program to make employees more conscious of the need for increased productivity.

Rochester, N. Y., bricklayers, masons and plasterers won a wage rate of $2.10 per hour, retroactive to January 1, in an arbitration award after a dispute with the Mason Carpenter Contractors Association. The award is 2½ cents per hour more than the recommendation made by a joint committee of contractors and building trades representatives last November, and increases the union's scale 40 percent over 1940.

Science foundation bill considered in Congress

Details of the Smith bill to establish a federal science foundation (*ENR* Feb. 27, vol. p. 337) were under discussion in Washington last week. The subject is on the Republican docket of "must" legislation and hearings have started.

The bill introduced by Senator H. Alexander Smith, R., N. J., has taken a stand opposite on nearly all controversial features from the Kilgore Bill of last year, which passed the Senate but was rejected by the House. Among its provisions are:

On administration: The foundation would consist of 48 scholars, serving part time, who would elect a director and an executive committee to administer the program of research contracts, grants-in-aid, and fellowships.

On patents: The Smith bill would require only that equitable patent provisions be included in research contracts.

An alternative bill incorporating the features of the Kilgore measure—a full time presidentially-appointed administrator, and a ban on patenting of research done with government funds—has been introduced by Senator E. D. Thomas, D., Utah.

Supreme Court reverses conspiracy conviction

Citing failure of lower courts to comply with requirements for instruction to the jury, the U. S. Supreme Court last week reversed conviction of an employer and a labor union for violation of the Sherman Anti-Trust Act. The case was remanded to the San Francisco Federal district court for retrial.

The parties to the suit—a group of San Francisco area lumber manufacturers and the United Brotherhood of Carpenters and Joiners (AFL), its district council, and the Alameda County Building Trades Council—were convicted of an illegal conspiracy to boycott out-of-state shipments of mill work into the San Francisco area, and to keep prices up by agreeing not to handle millwork "made at wages or under working conditions" inferior to those in the local area.

Although an illegal conspiracy under the Sherman Act was proven at the trial, the fatal error of the trial court, the Supreme Court majority held, was failure to instruct the jury that under section 6 of the Norris-Laguardia act, the individual defendants are entitled to having their participation in the conspiracy weighed by the jury. Section 6 provides that no association or organization (nor its members or officers) participating in a labor dispute shall be held liable for the unlawful acts of other officers or members, except upon clear proof of actual participation in such acts.

The case has been argued before the Supreme Court three times.

Press Assn. photo

***Mass Housing**—One of the largest privately-built mass housing operations is this settlement near Los Angeles, Calif., where Henry J. Kaiser's Community Homes is putting up some 10,000 prefabricated homes for veterans.*

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

Indianapolis, Ind., Buffalo, N. Y., other cities consider large sewer programs—Traffic problems, street and civic work concern Los Angeles, Calif., Phoenix, Ariz.—Youngstown, Ohio, to build new schools—Other municipal activities

The problem of providing adequate sewerage for their increasing industrial and residential populations was of prime concern to city officials and city engineering staffs at many points last week.

Biggest program under consideration was a $27,000,000 plan (based on 1946 costs) presented to the Indianapolis, Ind., city council by consulting engineers employed to survey the city's needs. The report urged consideration of plans for cooperation in sewage disposal with the 50 population centers immediately surrounding the city to prevent pollution of the White River and Fall Creek, which now receive some sewage discharges although both streams are used for the city's water supply.

At San Leandro, Calif., voters approved by a slim margin a $900,000 bond issue to provide a new sewage treatment plant, sanitary sewers and storm drains. The vote followed similar action last November by six metropolitan Oakland cities bordering San Francisco Bay to eliminate pollution of shore waters (*ENR* Nov. 28, 1946, vol. p. 705). The state Department of Public Health had forced action by prohibiting discharge of untreated sewage into the bay after January, 1947—with a time extension if cities took definite action toward construction of disposal facilities.

The Valdosta, Ga., city council began debate on a plan for a $1,500,000 combined water-supply-sewer system; and at Buffalo, N. Y., the city Sewer Authority received a proposal for construction of an $800,000 project to provide storm sewers in the northern section of the city.

Phoenix, Ariz., adopted a city ordinance calling for increased rates to be charged to users of the municipal sewer system when their property lies outside city limits. New rates prescribe a minimum charge of $18 yearly for a one-family private dwelling.

San Francisco's traffic

Mayor Roger Lapham of San Francisco, Calif., recommended to the city government that a $57,450,000 bond issue be floated to finance comprehensive plans for untangling the city's growing traffic snarl. Included in the mayor's program are: replacing street cars with trackless trolleys or buses on many routes; extension and improvement of principal traffic arteries; establishment of parking areas or garages, and modernization of the street lighting.

Other moves during the week aimed at improving street conditions included: Philadelphia, Pa., which proposed to spend $4,300,000 for removal of its "Chinese Wall" railroad trestle on Market street and $10,000,000 on other street improvements; Phoenix, Ariz., which will spend $662,000 for general street repairs and improvements.

Schools for Ohio

Voters of three Ohio cities—Cleveland, Akron and Boardman, have already approved bond issues totalling more than $23,000,000 to finance construction of new schools, and citizens of Youngstown, Conneaut and other cities will be asked to approve similar issues, for more than $7,000,000 in May.

Great Lakes port

The port commission of Monroe, Mich., will begin work this spring on the first of six slips for lake carriers, as a part of a $4,500,000 expansion project aimed at making Monroe one of the largest ports on the Great Lakes.

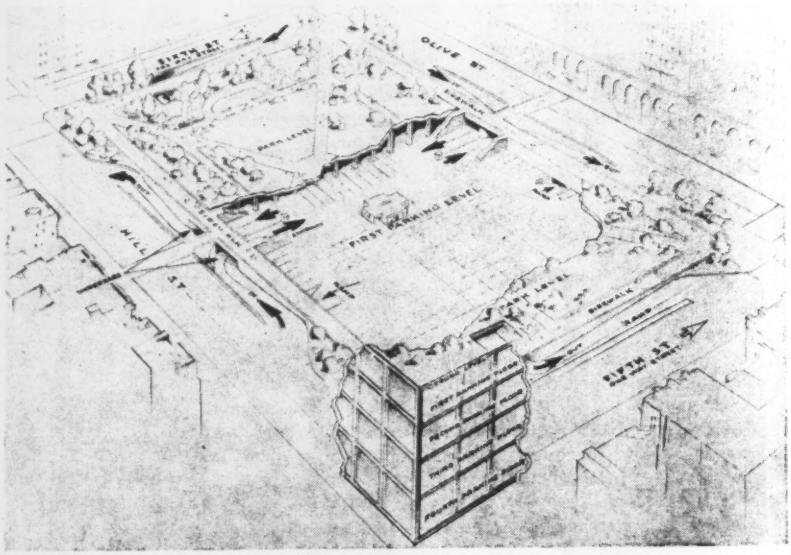
Present facilities include a 22-acre turning basin designed to hold eight ships for winter storage, an adjacent pier and revetment, and a transit storage building. New work will include three new basins, each 1,200 ft. long by 300 ft. wide; a slip for bulk carriers.

Bridge at Kansas City

An immediate start on construction of the $3,000,000 Liberty Bend Bridge, a key project in the flood control plans of Kansas City, Mo., is now assured with the confirmation of acceptance of a combined bid by the Massman Construction Co. and the Kansas City Bridge Co.

The new bridge, to span a new channel of the Missouri River north of Courtney on U.S. highway No. 71 bypass, is vital to flood control plans because it will make possible the elimination of the river's 6½-mile Liberty Bend and speed floodwaters past Kansas City.

A new shorter channel will be directed under the bridge.



Plan for Underground Parking—One of several proposals being considered by Los Angeles, Calif., officials to relieve downtown traffic congestion is this four-level garage that would accommodate 2,500 cars under Pershing Square Park, in the center of the shopping district. Sponsored by the Downtown Parking Association, the facility would cost an estimated $4,500,000. Ramps would provide access from floor to floor and from the street—with entranceways underneath existing sidewalks to make for minimum interference with pedestrian and street traffic.

New surplus sales plan on construction machines

A new and continuous program to expedite the disposal of surplus government owned parts for construction and other machinery and equipment and their attachments is ready to be launched, War Assets Administration has announced.

Items included in this sales program are: pumps; portable crushing plants, jaw and roll; portable screening plants; portable bulk conveyors; cranes, derricks, hoists and winches; earth and rock boring and drilling machinery and accessories; well and blast hole drilling machinery; excavating and dredging machinery; tractor-mounted construction equipment; mixers and pavers, bituminous and concrete and related equipment; railroad construction and maintenance equipment; miscellaneous equipment, tractors; and street-sweeping machine brooms.

The largest concentrations of construction equipment are at Voorheesville, N. Y., Hueneme, Calif., Granite City, Ill., and Gulfport, Miss.

Col. W. D. Luplow to head military operations, OCE

Col. Walter D. Luplow of Alexandria, Va., has been designated Director of Military Operations, Office of the Chief of Engineers, Washington, D. C. He relieves Col. Dwight F. Johns, who has been ordered to other duties.

Colonel Luplow was graduated from the University of Minnesota with a BS degree in civil engineering and went into the Army as a second lieutenant of infantry, joining the Corps of Engineers several years later. In 1921 he went to Coblenz, Germany, with the 16th railway battalion.

Routine assignments followed, including a tour as district engineer at Washington, D. C., in 1937 and 1938. He joined the Headquarters, III Army Corps at Brownwood, Tex., in 1942, later went to Camp Edwards, Mass., with the Engineer Amphibian Command and returned to the III Army Corps with which he landed in Europe, attached to Headquarters, ETOUSA, as deputy chief, Services of Supply. He was next attached to the UK base as chief engineer, and later rejoined the main army in France and Germany. He returned to the United States in 1946 and was attached to the office of Director of Military Operations, OCE, as deputy chief, until his present promotion.

Process taps new source for hardwood flooring

Production of a new-type hardwood flooring said to equal top-quality conventionel flooring will be achieved through a new guaranteed-market contract signed last week, according to Frank R. Creedon, housing expediter.

The material to be used is a three-ply, cross-laminated hardwood, 12 in. wide and made in any desired length. The flooring is made in a continuous glue press from small-size, cull-type hardwood logs, not ordinarily adapted to the production of flooring. Cost is said to be competitive with conventional flooring, and installation costs—owing to width of the boards—is less.

The new material was developed by the Tennessee Valley Authority, and a TVA pilot plant has been taken over for production by the Laminated Wood Products Co.

Canada to establish new Arctic weather stations

Canada is to establish nine new Arctic meteorological stations within the next three years as part of a joint Canadian-American-Russian enterprise in Arctic meteorology, according to an announcement by Reconstruction Minister C. D. Howe. Two of the stations will be situated not far from the North Pole, the northernmost being on Ellesmere Island, with the main station at Winter Harbor on Melville Island. The United States will assist Canada in the location of the remaining stations, and also with technical personnel.

Construction of the new stations will pose unusual problems in construction technique and in transportation since they will all be in isolated areas, far to the north of any other buildings except for one or two Hudson's Bay Company and R.C.M. Police posts. No detailed estimates of cost are available but it is said that "one first class station would cost about $100,000", to which would have to be added all special transportation costs.

Penna. expects record road traffic in 1947

The 1946 volume of traffic on Pennsylvania highways was within 11.9 per cent of that of 1941—the all-time high record. Traffic has showed a steady increase from the low of the war era, this was in 1943 when it was only 48.4 per cent of the 1941 figure.

Pipe manufacturers OK wire mesh standards

Simplification and standardization of wire reinforcing mesh received the approval of the American Concrete Pipe Association at its 39th annual convention in St. Louis, Feb. 24-26. The association suggested adoption of 28 standard sizes in place of some 320 used in the past.

According to E. F. Bespalow, chairman of the technical problems committee, the proposal may not be the final answer to simplification. The recommendation was developed on the basis of previous research and meetings with representatives of the Wire Reinforcement Institute. Following approval by the convention, the suggestion is being submitted to the U. S. Bureau of Standards, Department of Simplified Practices, for final analysis and decision.

Elmer L. Johnson, Concrete Conduit Co., Colton, Colo., was re-elected president of the association for a second 1-year term. Howard F. Peckworth, Chicago, continues as managing director.

Tripler Hospital cost greatly over estimate

The cost of the Army's new Tripler General Hospital near Honolulu, Hawaii, originally estimated at $14,600,000, is now expected to reach $32,975,000, Col. B. L. Robinson, Army district engineer, reported.

First cost of the hospital was boosted to $16,000,000 in a preliminary cost estimate, then, on the basis of plans and specifications, to $24,900,000 prior to the latest estimate. Labor shortages, slow production and shipment of materials and difficult construction features are blamed for the higher costs.

Protest non-professional engineers at Binghamton

The Broome Area Chapter of the New York State Society of Professional Engineers has protested steps of Binghamton city officials to permit non-professional engineers to qualify for the job of superintendent of the water bureau in Binghamton.

In a letter to Mayor Walker B. Lounsbery, L. E. St. John, chairman of the chapter's committee on ethics and practices, said that it was felt that the "best interests of public health of the city" require that a professional engineer be chosen for the position.

Quonset factory buildings expand plant capacity

Faced with a probable 2-year delay in the construction of badly-needed additional plant capacity, York-Shipley, Inc., manufacturers of oil-fired equipment, turned to the ubiquitous Quonset hut of war days to provide the needed space.

Now nearing completion at the company's York, Pa., headquarters, the plant additions consist of two Quonset-type buildings, each 82 ft. wide by 372 ft. long, providing a combined working area of 60,000 sq. ft. The structures will be used until a permanent new factory addition can be built.

Were erected quickly

Lending themselves to quick erection, the buildings have a triple arch, centrally supported by vertical steel members. The exterior consists of corrugated iron sheets on a steel-arch framework, insulated with a 2-in. layer of rock wool, covered by a finish of ½-in. fiberboard. Floors are poured concrete.

The buildings are heated by a single unit, manufactured by the company, supplying low-pressure steam to eight floor-type fan-fin heating units, of which four are placed in each plant. The heating unit is a completely self-contained, oil-fired, power plant, with a rated capacity of 100 hp., using 15 psi. steam. The eight floor heaters are arranged to distribute warm air evenly throughout the buildings above head level.

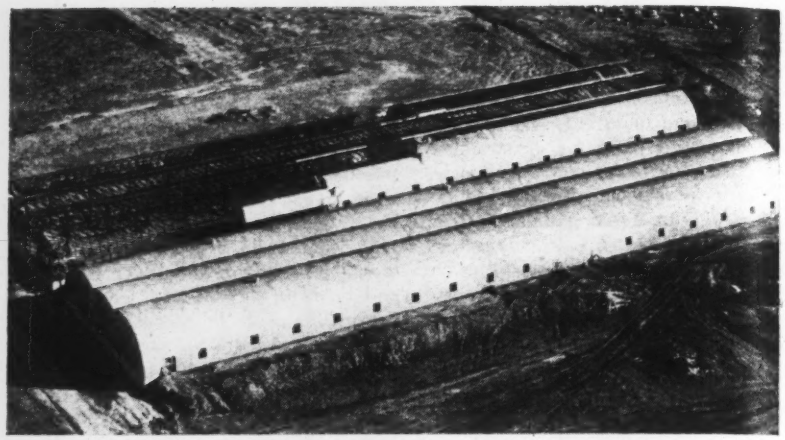
For mass production

The principal function of these Quonset plants, however, is the mass production of a packaged, oil-fired winter air conditioning unit for use in veteran housing projects. Production of these units in the new plants is scheduled to begin March 1.

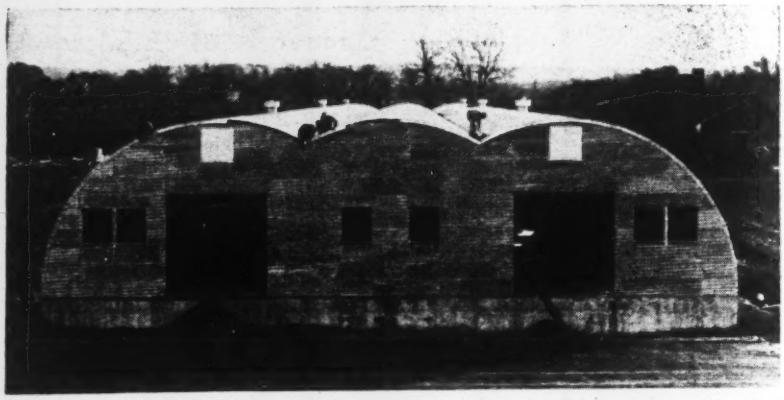
Certain manufacturing processes for parts for these heating plants, in addition to other company products, will be housed in the new additions.

During construction, the center section of the buildings was left open for easy entrance of cement mixing equipment, ditch-diggers used to open sewer and water line trenches, and insulating and other materials. Large-size double doors at either end of the structures will be used on completion for moving equipment and supplies.

The architect supervising plant arrangements is Frederick J. Rempp of York, Pa. Contractors are R. S. Noonan, Inc., of York, and the Great Lakes Steel Corp. supplied the framework and the galvanized iron roofing and siding material used in the buildings.



A quick way to increase working space at a plant manufacturing oil-fired equipment was the use of these unusually-large Quonset-type structures. Each building is 82-ft. wide by 372 ft. long, providing a total of 60,000 sq.ft. of new working space to be used until a permanent factory can be built. This same location—a plot of 43 acres—is to be the site of the plant which eventually will supplement the Quonset buildings to provide much-needed additional manufacturing and office space for the company.



Double doors at either end of the Quonset plants provide ample room for movement of materials and equipment for manufacturing operations.

Interior view shows (at left) finished inside wall of fiberboard, and at right, first layer of 2-in. rock-wool insulation has been put in place. Clean, light appearance of the finished interior is expected to improve worker efficiency.

OBITUARY

Henry Harrison Courtney, 73, former steel construction engineer of Chicago, died March 5 at Sanford, Fla., where he has made his home for the last six years.

Frank Wilmer Hawks, 81, valuation engineer of the Virginian Railway Co., whose first assignment with the road was the construction of a 2,200-ft. bridge over the New River in Virginia, died March 2 in Norfolk, Va.

B. F. Williams, 72, for many years Texas state reclamation engineer, died at Austin March 7.

Franklin A. Smith, 43, Woodmont, Conn., a partner in the Smith-Hall Construction Co., died March 9. Mr. Smith was a Trinity College civil engineer graduate.

Thomas B. Hudson, Chilton County engineer and formerly engaged in private and federal engineering in Pittsburgh, Pa., and in Birmingham and Montgomery, Ala., died March 6 in Clanton, Ala.

George W. Hutchinson, 54, engineer and first head of the North Carolina Highway Department's testing division, died at Raleigh March 10. He had been consulting engineer for Claytor Dam of the Appalachian Electric & Power Co., Radford, Va.

Frank A. McComber, 65, for 15 years chief engineer and manager of the city water, gas and sewage disposal departments at Duluth, Minn., died recently.

Calvin B. Felger, associate engineer in the Nebraska State department of roads and irrigation for the past ten years, died recently.

Henry H. Pickett, 51, engineer in charge of the final estimates department of the South Dakota State Highway Department with headquarters at Pierre, died recently.

Charles W. Clapp, 84, organizer of Clapp & Abercrombie, Utica, N. Y., civil engineers, died at Utica March 5.

Frank H. Vinson, 89, retired dredging engineer, died in Phildelphia, Pa., Feb. 23. Until his retirement ten years ago, he had been associated for 60 years with the firm of P. Sanford Ross and Sons, engaging in many dredging operations along the Atlantic seaboard.

James O. Winston dies, built water-supply dams

James O. Winston, last of four brothers who became famous as dam builders in the East during the early part of this century, died at Kingston, N. Y., March 13 at the age of 82. He was remotely related to the Winstons who became famous somewhat earlier as railroad builders in the West.

James O. Winston and his brothers began as subcontractors on the Chicago Drainage Canal under MacArthur Brothers. Following the canal work they were associated with C. H. Locher under the name of Winston and Co. & Locher on power and railroad work in Virginia.

When bids were called on the Wauchussett Dam for the Metropolitan Water Board of Boston the Winstons and Lochers associated themselves with MacArthur Bros. in the building of that dam and later for work on the Weston Aqueduct. Following that work, the Winstons and Lochers built bridges and tunnels for the Western Maryland R. R.

In 1906 the Winston Company got the contract to build the Ashokan Dam for the New York Board of Water Supply, subsequently taking on the relocation of the Ulster & Delaware R. R. that was made necessary by the Ashokan project.

In later years the firm built other water supply dams in the east, did more railroad work and participated in construction of the New York subways.

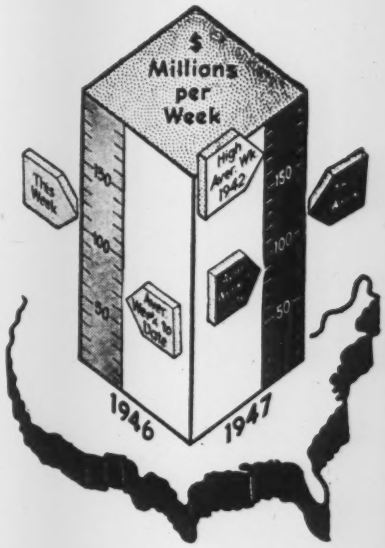
Brig. Gen. Jervey dies, supervised Gatun Locks

Brig. Gen. James Postell Jervey, (retired), 77, who supervised construction of the Gatun Locks in the Panama Canal from 1908 to 1913, died in Washington, D. C., March 12.

A graduate of the U. S. Military Academy in 1892, he was commissioned in the Corps of Engineers and served in Florida in the Spanish-American war. He commanded an engineer company in the Philippines in 1905-07 and later was director of civil engineering at the U. S. Engineer School.

After his work at Panama he was district engineer at Wheeling, W. Va., and Norfolk, Va. In the first world war he was division engineer of the 79th Division, chief engineer of the 7th Corps and assistant to the chief engineer of the AEF in France. General Jervey retired from the Army in 1920 and later from the faculty of the University of the South at Sewanee, Tenn., where he had been professor of mathematics. He has been city manager of Portsmouth, Va.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Mar. 20 1947	Cumulative 1947 (12 wks.)	Cumulative 1946 (12 wks.)
Federal	$2,804	$81,752	$96,485
State & Mun.	23,756	285,100	196,177
Total Public.	$26,560	$366,852	$292,662
Total Private	82,520	760,892	552,709
U. S. Total	**$109,080**	**$1,127,744**	**$845,371**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (12 wks.)	Cumulative 1946 (12 wks.)
Waterworks	$2,877	$25,146	$25,869
Sewerage	1,765	19,324	9,668
Bridges	629	33,197	22,061
Highways	11,341	114,589	100,658
Earthwork, Waterways	1,372	26,408	59,193
Buildings, Public.	7,874	101,525	55,797
Industrial	7,420	179,513	226,380
Commercial	67,271	468,083	291,919
Unclassified	8,531	159,959	53,826

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (12 wks.)	Cumulative 1946 (12 wks.)
NON-FEDERAL	$233,371	$176,334
Corporate Securities	23,688	75,987
State and Municipal	209,683	100,347
FEDERAL	.....	158,320
Total Capital	**$233,371**	**$334,654**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	Mar.'47	391.93	188.40
Building Cost	Mar.'47	298.82	161.53
Volume	Feb.'47	197	86

EDITORIALS

VOLUME 138 NUMBER 12

March 20, 1947

Greece and Turkey

THE CONSEQUENCES of President Truman's message on Greece and Turkey, now being debated in Congress, have received more attention on the military than on the civilian side. Yet at least half of the proposed $400 million dollar loan is earmarked for such things as highways, railways and sanitation. Thus, if the proposal heralds, as many conceive, a new foreign policy for the United States, engineers and construction men are destined to occupy prominent roles in its implementation. That being so, they will want to see it work fairly for the benefit of those upon whom it may come to bear. The money must be spent honestly, efficiently and effectively. It must be spent with the prime objective of raising living standards and increasing the happiness of the peoples served. At the same time it must be regarded as an investment on our part and not as a gift. If we are to take over the liabilities of various parts of the world, we are also entitled to the assets to a degree that will amortize the investment. That would be sound for a private business, and it is sound for a foreign policy that is to last long enough to bring the world back to health. Engineers and construction men will want to watch—and guide where possible—the development of the policy in Greece and Turkey, where it may get its first test.

Surplus Equipment Abroad

DEEP CONCERN was expressed at the recent meeting of the Associated Equipment Distributors in Chicago over the possibility that surplus construction equipment sold by the government to purchasers abroad would be "dumped" on the U. S. market. An order issued by the Department of State in January permitted the importation of certain types of equipment and materials held to be in short supply in this country (*ENR* Feb. 20, vol, p. 257). Fortunately, as a result of many protests, the State Department, issued a new order on Feb. 20 that takes most items of equipment off the list. However, although this order clears up a confused domestic situation, something still needs to be done to help construction men in Europe who are very anxious to get our surplus supplies. Quick cutting of red tape that would put equipment in the hands of such potential purchasers would serve two purposes—it would help in the rehabilitation of European countries and it would build up acceptance for American construction equipment that should pay big dividends in export business in the future.

Water's Destructive Energy

A MOST SPECTACULAR EXAMPLE of erosion below a dam spillway is reported in this issue. What happened at the Lake Waco Dam in Texas serves again to emphasize the need for precautions in handling large quantities of spilling water, especially when the underlying rock is in nearly horizontal beds. When the dam was built about 17 years ago the designers put the spillway apron nearly 9 ft. below normal tailwater level to form a pool in which it was expected that the energy of the falling water would be harmlessly dissipated. But high floods swept over the structure to start erosion below the apron that ultimately destroyed it and endangered the stability of the dam. Model studies probably would have revealed the possibility of such action, but that was before hydraulic models were as commonly used as they are today. Yet, even now, selling the need for model studies to a city council or similar agency that must provide the funds is not too easy. Hence, the special significance of the Waco Dam trouble for engineers, since its spectacular character may help to convince the uninitiated of the importance of adequate preliminary investigations.

Promoting Public Health and Service

THE ANNUAL REPORT of the Georgia Department of Public Health is a simple, unpretentious document consisting of a half-dozen mimeographed pages. Neither in style or format does it measure up to reports from dozens of similar agencies. But in content and as example of a friendly, informative and persuasive statement it has few peers. One can well believe that local officials and citizens for whom this report was prepared will better understand the nature of public health protective facilities and how they can be improved. And they cannot help but feel the sincere and conscientious attitude of their servants in state headquarters when they read in the foreword that: "Requests to the department on any subject relat-

ing to safe water supply and adequate sewerage . . . will be given special attention and specific reply." Signed by W. H. Weir, Public Health Engineer, this annual report also is distinguished by the fact that it was issued within ten days after the year ended. In its prompt appearance and content, this accounting of stewardship bespeaks the work of those who have a profound appreciation of public service and the way to promote it.

Profession or Trade

MANY YOUNG MEN just out of the army or soon to be out of high school will learn in the next few weeks that colleges do not have room for them to start engineering training next fall. For some it will be a serious setback to an engineering career. For others it may prove an opportunity if they take advantage of the possibilities of apprenticeship training to enter the construction field.

The present is an excellent time for anyone willing to work to start in construction. There has been little apprentice training in many years, and the average age of workers is high, indicating plenty of opportunity for new blood. Also, there is great need for new leaders who will restore pride in craftsmanship to its former high standing in the construction industry.

As to remuneration, the 20-cities average of wages reported in this journal (March 6, vol. p. 403,) is $1.92 per hour for skilled workers in construction trades, some $4,000 per year exclusive of overtime. This rate is reached in most cases after four years of training, with pay while learning amounting to 50 to 80 percent of a journeyman's wage.

Getting into apprentice training programs will be the most difficult step. In the first place, there are too few of them. Also, entrenched workers in many cases are resisting apprentice training and limiting admission to relatives and friends of members. Still, difficulties of starting craft training generally are no greater than getting into college.

To those who counsel young men on careers we suggest that the advantages of apprentice training be brought to the attention of prospective good workers. For many it will suit their talents better, for some it will lead to greater responsibilities and remuneration through foremanship and eventual direction of construction. There is little question that some will do better by training in craft work for construction than by going to college.

Limits on Irrigated Acreage

CANALS TO DELIVER WATER to land in the Central Valley in California are the next big item of construction on that great irrigation and power project, as reported in this issue. That fact serves to emphasize the related fact that about one-third of the land in the project is not eligible for project water because it is in holdings exceeding the acreage limitations of federal land-reclamation laws. Serious differences of opinion exist as to whether these limitations are proper or whether this project should be exempted from such restrictions as was done on the Colorado-Big Thompson project because it merely supplemented existing irrigation water.

The major irrigation purposes of the Central Valley project are likewise to supplement water supply on land already developed as well as to open up large new areas. Some water for the land already irrigated comes from surface supplies, but most of it is obtained by pumping from underground sources. Farmers who do not elect to reduce their holdings to within limitations are not forced to sell, but can continue to work their land by using water supplies already available. In such cases, an attempt to restrict benefits to eligible land could be made by delivering water only through canals and laterals, but the increased use of water would be sure to raise the watertable nevertheless. When that happens, ineligible farmers would receive free the benefit of reduced pumping cost.

In the case of newly developed land, which will receive all of its water supply from project sources, acreage limitations would protect new settlers from land speculation. However, a plan that would provide this protection and also would be in line with Colorado-Big Thompson reasoning could be worked out. Under such a plan, rather than put limitations on the entire project, it should be possible to define the areas that are now irrigated as opposed to those to be newly developed, and then exempt from the acreage limitation land receiving supplemental water.

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ENR staff photos

Roads to Riches In Venezuela

Edward J. Cleary,
Executive Editor, Engineering News-Record

Fig. 1. Wildcat well of the Creole Petroleum Corp. alongside the Guarico Road.

***Contents in Brief**—New roads from the coast to the interior of Venezuela that are being built by the oil companies not only expedite the development of a great natural resource but provide the basic elements of a transportation system in hitherto inaccessible areas. Newest addition to the system of some 1,000 miles of highway already built is the Guarico Road nearing completion in the north-central part of the country. Design and construction practice on this and the Jusepin highway, which was finished last year, are based on U. S. Public Roads Administration standards.*

WHAT good highways mean to the economic life of a nation probably is nowhere more dramatically apparent than in Venezuela. A pioneer country that ranks second among the world's oil producers, highways in this land of "black gold" are the roads to riches.

This conclusion is inescapable because here the oil industry moves on wheels. And the roads that enable these wheels to move over the mountains, through the jungle and across the plains of Venezuela are basic to the exploitation of her oil resources.

What the development of these resources spells in terms of direct financial returns to Venezuela is indicated by the fact that up to three-quarters of the national budget requirements in recent years has been met with royalties and fees from oil company operations.

Quite aside from providing access to areas for the exploitation of oil, these all-weather roads opened to public use have brought other "riches," the value of which cannot be so precisely measured. They have provided transportation facilities to places that hitherto were virtually inaccessible, brought the interior into contact with seacoast ports, promoted business and otherwise are paving the way toward prosperity and higher standards of living.

A road to find oil

The latest highway in the system of some 1,000 miles of road built by the oil companies is a 200-mi. stretch now under construction in the state of Guarico, between the Carribean port of Puerta de la Cruz and El Sombrero (see map). It is a unique undertaking in that the cost of some $6,000,000 is being shared by eleven oil companies. This is probably the first time that private enterprise in South America has embarked on such a joint enterprise without assurance of finding oil to guarantee the investment.

Although oil has not yet been discovered in this area, geological findings indicate that it might be present. On this basis concessions for exploration were secured by eleven companies and already test wells are being driven. Exploration, of course, requires accessibility to area, a considerable part of which is wild and uninhabited country. To obtain quickest entry to the area, road construction was begun simultaneously from both ends.

The Creole Petroleum Corp., an affiliate of the Standard Oil Co. of New Jersey, and the biggest operator in Venezuela, is in charge of the planning and construction of the project, which is known as the Guarico Road. Overall supervision

is provided by a committee of five members from the participating companies.

Costs are allocated among the companies on a pro rata basis, ranging from 0.7 to 34.6 percent. (See table). Specific allocations were determined by a formula in which the following factors were recognized: Size of the concession serviced by the road and its distance from Puerta de la Cruz; distance from the concession to the road; and proximity of roads already existing.

As far back as 1944, Creole engineers began the survey for the highway, which took 18 months to complete. All of the work had to be done by ground parties because of war restrictions, which prohibited plane flights for aerial surveys. Difficulties were very great because much of the route traversed jungle country and there was little opportunity for communication. Not the least hazards were the jaguars, which managed from time to time to kill pack burros that were corralled at the surveyor's camps.

"Equally time-consuming," stated E. G. Shuler, chief highway engineer for Creole, "was the matter of purchasing rights-of-way once the location was determined. Since there are no land taxes in Venezuela, records of ownership are not easily available. As a consequence we had and still have, in fact, a large crew of men in the field doing nothing but tracing owners and heirs of owners."

Construction finally got under way in the spring of 1945, with the award of a contract to Williams Bros. Corp. of Tulsa, Okla. At the present time some 80 miles of road from the east end and 54 miles from the west end has been graded and gravelled. The most difficult stretch—in the center, where heavy jungle growth and swamps predominate—is now being tackled.

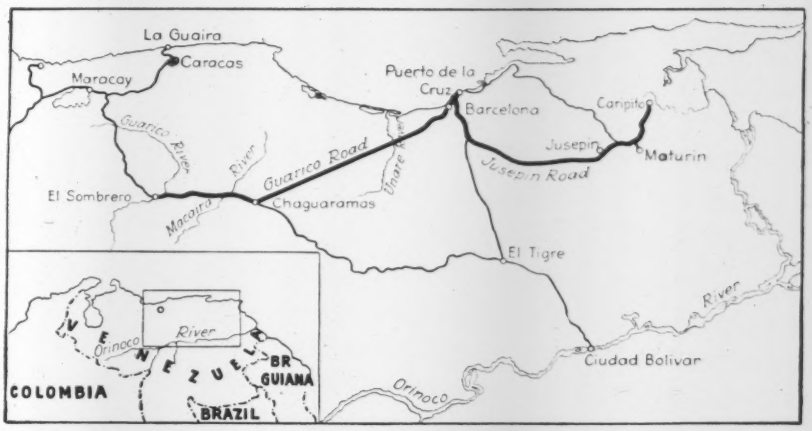


Fig. 2. Newest additions to the oil company highways in Venezuela are the Guarico and Jusepin roads. The Guarico Road, now under construction from the northeast coast to El Sombrero, connects with an existing highway leading to the capital city of Caracas. It is being built by eleven oil companies who hope to develop new producing fields in this area. The Jusepin Road provides a high-speed route from producing areas to the coast port of Puerta de la Cruz.

Building the Guarico road

Primarily an earth-moving job—involving the handling of some 2,000,000 cu. yd.—construction of the road thus far might be characterized as a "natural" for the use of heavy equipment.

First step calls for clearing the right-of-way of trees and roots, which is accomplished with bulldozers. The soil in this region is a clayey loam free of rock, and consequently scrapers are ideally adapted to the task of grading. The terrain is flat to semi-mountaineous, and for the most part is of a rolling nature.

The base and surface course consists of 4 in. of gravel which is spread with a patrol grader. Gravel deposits, containing a mixture of sand and water-deposited stone ranging in size from $\frac{1}{2}$ to 3 in., are found at infrequent intervals close to the right-of-way. The material is easily handled with a $\frac{3}{4}$ yd. shovel or dragline and $2\frac{1}{2}$ ton dump trucks, which shuttle back and forth to the point of application.

Trucks carrying heavy oil-field equipment make use of the road as soon as the surfacing is spread. Consequently, the larger, undesirable sizes of gravel are quickly worked out to the edge of the road, leaving the travelled portion quite smooth and hard. How well this is accomplished is evidenced by the fact that within a few days light passenger cars can travel over the road with safety at speeds up to 50 mph.

PRA standards of design

Traveling at high speeds for long periods of time is facilitated by the location of the road as a series of long tangents with easy curves. Basic design is such that when the project is completed, the highway would meet U. S. Public Roads Administration requirements for a "first class secondary road" designation.

The right-of-way is 197 ft. wide with the center-line of the road located

PARTICIPATING COMPANIES AND DISTRIBUTION OF COSTS FOR THE GUARICO ROAD

Companies	Percentage of contribution
S. A. Petrolera Las Mercedes (subsidiary of the Texas Petroleum Co. and of Caracas Petroleum, S. A.)	34.6
Cerole Petroleum Corp	20.9
Venezuelan Oil & Transport, Ltd	18.0
Venezuelan Atlantic Refining Co	4.6
Sinclair Oil Co	5.8
Caracas Petroleum, S. A	4.4
Socony Vacuum Oil Co. of Venezuela	3.9
Mene Grande Oil Co	3.1
Pantepec Oil Co. of Venezuela	2.3
Phillips Venezuelan Oil Co	1.7
Petroleum Investments (Overseas) Ltd	0.7
Total	100.0

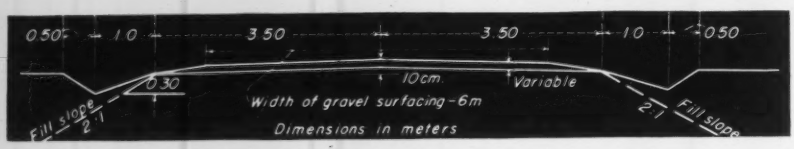


Fig. 3. Right-of-way on the 20-ft. wide Guarico Road is 197 ft., the center-line of road being located 45 ft. from the southerly side; the northerly part is reserved for future pipeline and utilities. Road details are shown in the section.

45 ft. from the southerly side; the northerly part of the right-of-way is reserved for the installation of future pipelines and other utilities.

Width of the present gravel road is 20 ft. When and if a bituminous paving is added, the finished width will be 33 ft. including shoulders. Other details of the road design are shown in the accompanying stretch.

One of the principal problems in the design of these highways, stated L. M. Dyal, assistant chief highway engineer of Creole, relates to drainage provisions.

"There is no basic data available and sizes of drainage structures can be determined only by running a few cross-sections on the streams to be crossed and then applying a rule of thumb rain-intensity estimate of 6 in. fall in four hours. Quite understandably, this leads to occasional maintenance troubles from washouts."

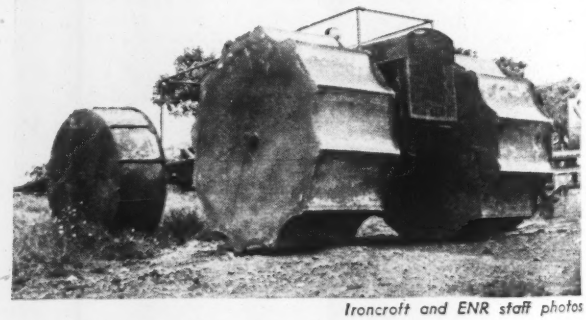
High maintenance costs

Mr. Dyal then went on to point out that the dry season (from January to June) also posed special problems in maintenance. During this period virtually all the moisture is lost from the soil, resulting in the gravel surface becoming loosened. Eventually the surface needs reworking and gravel replacement.

Installation of permanent bridges, of which there will be eleven, has been started by construction of the three largest bridges, namely those at the Memo, Orituco and Unare rivers. Temporary crossings consisting of timber decks supported on 8-in. pipe piles are being used; in most cases these are located downstream a short distance from the site of the permanent bridges. The latter vary in size from 20 ft. to 780 ft. The bridges are concrete deck on steel I-beams, with pipe piling. The 780 ft. bridge at the Unare River has a 225-ft. clear span.

Some idea of the difficulties in getting started on the job was gained in a conversation with Dave Williams, vice-president of the contracting firm. He pointed out, for example, that it cost as much as $1,000 to transport a single tractor from the field camp at Puerta de la Cruz to certain locations that could be reached only by circuitous travel through back country trails. Then there is always the problem of carrying spare and repair parts, which on this job called for an inventory value of over $200,000.

Long established in construction operations in foreign lands—with more than ten years experience in Venezuela alone—Mr. Williams was not complaining. He was simply pointing out that work in foreign fields calls for adjustment to special conditions. On the Guarico job, over which he is exercising personal field supervision, the payroll includes about 100 North Americans and be-



Ironcroft and ENR staff photos

Fig. 4. Exploration and survey crews on some sections of the road used the "Marsh Buggy" to facilitate their work. This machine, with large-diameter drum-type wheels to give it buoyancy, operates on land, across swamps and in water. Powered with a 100-hp. Ford engine, the 3-ton buggy travels 8 miles per hour on land and 5 in the water. Front driving wheels are 7 ft. dia. and the rear steering wheels are 6 ft. dia.; width of wheels is 3 ft.

tween 300 and 400 Venezuelans.

The high standards of road construction evidenced in the Guarico project reflect the philosophy of men with a background of state highway department experience—Mr. Shuler in South Carolina and Mr. Dyal in Georgia—prior to their association with Creole in 1941.

About seven years ago, stated Mr. Dyal, development of the oil fields in eastern Venezuela had reached the stage where pioneer access roads laid down in the previous decade were proving inadequate. Operations in these fields, located some 100 miles southeast of Puerta de la Cruz, depend entirely on land transportation facilities. Roads built previously for exploration work in the early Thirties were located largely on the basis of immediate expediency, and lacking knowledge of future needs only a minimum was spent on original construction.

Because of the heavy tonnage carried over these roads in recent years it became very costly to maintain them in suitable condition. This led to a rebuilding program based on the policy that all main roads be: (1) laid out in accordance with PRA specifications for U. S. secondary type highways; (2) founded on a well compacted 6 in. gravel base of 23 ft. in width; and (3) surfaced with 2 in. of bituminous pavement for a width of at least 20 ft.

The bituminous surfacing that has been adopted is a sand-asphalt road mix, containing 6 to 7 percent of an RC-2 cutback. Using a 2-in. bituminous surface the completed road cost is about $52,000 a mile. On sandy sections a 6 in. mixed-in-place sand-asphalt pavement is used with excellent results.

Fig. 5. Semicircle sections of corrugated iron pipe are assembled (top) and tailored to length on the site to fit drainage needs; the sections are shipped "nested" to facilitate their transport. With the drainage pipe in place, carrying scrapers (below) haul fill to bring the road to grade.

Highlights of the Jusepin road

Most recent example of a high type highway is a 67-mi. section of the road from Puerta de la Cruz to Jusepin, which was completed in 1945. This was a joint enterprise financed by the Creole Petroleum Corp. and the Mene Grande Oil Co. (subsidiary of the Gulf Oil Co.) at a cost of some $3,330,000. Designed and supervised by Creole engineers, it was built by the Raymond, Morrison, Knudsen Company, C. A.

Crossing a range of hills that separates the coast from the interior plains, the highest point of the Jusepin road is 1,300 ft. above sea level. Some 27 miles of the highway traverse the hills, and the remaining 40 miles are across a flat terrain.

Laid on a compacted gravel base 6 in. thick and 23 ft. wide, it carries a mixed-in-place asphalt pavement 2 in. thick and 21 ft. wide.

The location was made so that the maximum grade does not exceed 7½ percent, and the minimum sight distance is not less than 650 ft. Maximum super-elevation of curve sections is 1.3 ft. The design for truck speeds is 60 mph.

All the stream crossings are made on reinforced concrete deck bridges, which are designed to carry moving loads consisting of a 20-ton truck pulling a 16-ton trailer. Bridge widths are 23 ft., which is two feet

Fig. 6. Crossing the hills that separate the coast from the interior plains, the Jusepin Road connects Puerta de la Cruz with the eastern oilfields. Laid on a compacted 6-in. gravel base is a mixed-in-place asphalt pavement 2 in. thick and 21 ft. wide. A pipeline and power line are installed on the right-hand side.

wider than the paved surface of the road. The bridges range in size from 20 ft. to 500 ft.

Roads are binding the nation

Aside from its usefulness as a high-speed, heavy-capacity transportation route to the oil fields, as well as providing easy access to the pipelines that lie adjacent to it, the Jusepin road achieves distinction as a vital public service facility in eastern Venezuela.

An all-weather highway in this part of the country, which has a long wet season, brings benefits not heretofore enjoyed by the people. Furthermore, in traversing a region that has been only sparsely settled, the road already has promoted the establishment of several small settlements, as well as providing a direct connecting route for towns that formerly lacked means of easy access to the coast.

In building roads for the immediate purposes of bringing out the "black gold" of Venezuela, an essential network of communication facilities is also being established for bringing together the peoples of Venezuela. And it is a united people and the coordination of their efforts that are the true riches of a nation. To this end, a vital role is being played by the oil companies in Venezuela in "building roads to riches."

Fig. 7. Aside from its usefulness as a high-speed, heavy-capacity transportation route for the oil companies, the Jusepin Road has promoted establishment of new communities in areas that were sparsely settled. An all-weather highway in this part of the country, which has a long wet season, brings numerous public service benefits.

AASHO Technical Discussions Bring Out Useful Ideas

***Contents in Brief**—Useful suggestions made in discussions by highway maintenance and road construction engineers at the recent meeting of the American Association of State Highway Officials are summarized, including comment pertaining to latex crack fillers, methods of sanding icy pavements, treatment for dusty roads, use of membrane concrete curing, and repairing cracked concrete pavement.*

MEETINGS of the Committee on Maintenance and the Committee on Road Construction at the recent convention of the American Association of State Highway Officials provided forums for an exchange of ideas on these subjects. Some of the more significant statements made at those forums are presented in the following, which supplements a news report on this meeting published in *ENR* Jan. 2, 1947, vol. p. 6.

Latex crack filler

During a discussion of fillers for cracks in concrete pavements at the meeting of the committee on maintenance, F. N. Hveem, materials and research engineer, California Division of Highways, reported that a mixture of latex and asphalt has been used successfully in California. During the war, the natural latex previously used with good success was unavailable. Recently, as the result of experiments with various types of synthetic rubber, a Buna S type was adopted which is just as satisfactory as the prewar type and costs less. An SC4 or SC6 asphalt is emulsified in the rubber and the mixture is poured into the crack or hole. Sodiumfluorosilicate in powder form is then applied as a congealing agent. This crack filler is applied cold and thus expensive heating facilities are eliminated. The cost of the mixture is about $1.50 per gallon. Prewar installations have held up well for as long as 10 years.

C. L. Motl, Minnesota maintenance engineer, presented the problem that northern states have during the spring thaw in restricting the load limit on certain secondary roads to avoid excessive damage due to heavy trucking. Excessive moisture in subgrades during this period reduces the load carrying capacity of the pavement with the result that only 3,500 miles of the 11,000-mile Minnesota system can carry full legal loads. Minnesota's problems, and those of other northern states, are (1) determining the amount of seasonal load reductions and (2) enforcing them. Mr. Motl stated that the latter is largely a matter of public education.

In an effort to solve both problems, Minnesota is using a truck-mounted testing device. Tests were made last year on certain pavements and will be made again this spring to determine the actual decrease in load carrying capacity.

To determine load restrictions in California, according to T. H. Dennis, Division of Highways maintenance engineer, public hearings are held during which all persons interested are allowed to present evidence regarding a certain road. On the basis of the information thus obtained, the responsible engineer determines the load limit and it becomes law. Such a limit may be made to be effective only during certain periods each year.

Availability of equipment

The results of a public roads administration survey on the availabilty of equipment were presented by H. A. Radzikowski, chief, maintenance division, Public Roads Administration. Several Midwestern equipment manufacturers were asked the length of time required for delivery on orders placed now. The results were as follows: (1) Power graders, 1 to 2 yr.; (2) power shovels, 1 yr. to 18 mo.; (3) tractors, 6 mo. to 1 yr.; and (4) scrapers, 18 mo. to 3 yr. As many orders that are now placed are double orders (i. e., orders from the same source placed with two or more equipment manufacturers), future cancellations may reduce the time required for delivery. In general, the companies reported that they would be interested in new foreign orders in about 1 year, indicating an expected opening of the equipment market by that time.

Remetalizing equipment costing about $1,000 has been a life saver in equipment maintenance, according to R. H. Stalnaker, equipment engineer, California Division of Highways. With this equipment the cost of remetalizing crankshafts is $30 each as compared with new ones at about $70. To date California has had no serious failures of remetalized shafts.

Treatments for ice and dust

Much discussion was held regarding proper methods of sanding ice-covered roads. Too much sand is objectionable because it clogs subgrade drainage systems. The too frequent application of salts is also considered objectionable because of the action on concrete. After sand is applied to ice-covered roads, the action of passing cars quickly moves it into windrows along the side of the roads. H. C. Anderson, assistant chief engineer, British Columbia Highway Department, suggested the use of a power broom to move such a windrow of sand from the side of the road back to the traveled surface. This broom, besides redistributing the sand, also roughs up the surface of the ice, giving it better non-skid qualities.

On the question of combating dust on secondary roads with traffic ranging up to 750 or 1,000 cars per day where it is not economical to use high-grade paving, Rex Whitton, maintenance engineer, Missouri State Highways, suggested the use of road

oil on such surfaces. About 0.7 gal. per square yard of SC2 road oil as an original coating will form a slight mat and thus keep dust down. He admitted that potholes will form and patching will be necessary, but even so he felt it is better than nothing. New dirt and oil can be added later as needed. Representatives from several other states seconded this suggestion.

Membrane cure for concrete

The membrane method of curing concrete was accepted by many of the state highway departments as an emergency measure during the war period when both labor and other types of curing materials were not available. The extent to which it has been accepted varies among the states; some permit its use for all concrete, including structures; others employ that method for curing pavement slabs, curbs and gutters only.

It was generally agreed by members of the Committee on Road Construction that with complete coverage the membrane retains sufficient moisture for satisfactory curing. However, some of the states feel that the mat or paper types of curing are more satisfactory since they provide a definite covering and permit adding more water, all of which prevents extreme temperature changes in the new concrete from rays of the sun.

The need for standardization of the numerous compounds and for improvement of equipment to apply them was strongly indicated.

Entrained air in concrete

Representatives from several states reported good results with the use of air-entraining cements and admixtures. Laboratory tests and field experience both show that air-entrained concrete is not subject to the serious and destructive scaling caused by the use of salts for ice and snow removal.

It was felt that the lower initial strengths obtained with its use, while not desirable, are not too objectionable, for in most instances the strengths were still above the minimum required. The Indiana State Highway Department reported that tests made by its department on air-entrained concrete showed no appreciable reduction in strength after 16 cycles of freezing and thawing.

The extent of the use of air-entrained concrete by the different states varies; some states specify its use in concrete for pavement slabs, curbs and gutters only; other states are specifying its use in all concrete, including structures.

C. M. Hathaway, engineer of construction, Illinois Division of Highways, and chairman of the Committee on Road Construction summed up the discussion by stating that the use of air-entraining cements and admixtures definitely imparts many desirable qualities to concrete, but that further study of its attributes is needed. Meanwhile its use will be continued.

Density of subgrades

Iowa recommended specifying the number of passes by sheepsfoot rollers in compacting embankments or subgrade. This the Iowa engineers contend, is better than specifying the density required as it does not depend to any great extent on laboratory tests. In Iowa six to twelve passes by sheepsfoot rollers are specified, and if the resident engineer is not satisfied with the compaction, he can require more passes. Such additional passes are paid for as an "extra."

California reported that by careful layering, specified density can be attained. The engineers of that state recommend using 8-in. layers for fill work except that 4-in. layers be used in the top 2½ ft. In some cases California requires 1-ft. excess fill with compaction by sheepsfoot roller. The action of these rollers is such that the top few inches of fill is loose and the excess fill is later bladed off.

Soil-cement bases and subgrades

That soil-cement bases should be constructed under favorable weather conditions was pointed out by engineers of the Washington Department of Highways, who told of two test sections built six years ago. One section built under favorable weather conditions and immediately given a light bituminous surface treatment has given satisfactory service for six years. The other section was built in the late fall under adverse weather conditions and too late to be given a bituminous surface treatment. The following spring this section had scaled badly but was given a light bituminous surface treatment. It also peeled off under traffic. A 2-in. bituminous road mix was then placed and the road has now given satisfactory service for five years.

With laboratory tested and selected materials, California has obtained some good compression strengths of soil-cement mixes containing five to seven percent of cement by weight. California now is building some soil-cement bases by road mixing approved road materials and by plant mixing imported materials. These bases, when surfaced with 2½-in. of bituminous mixtures, have been giving satisfactory service even on main-line roads.

California now is using 4-in. of soil-cement mixtures as a subbase for concrete pavements with the thought that it will prevent pumping and the resulting step-off between slabs.

California also reported the conversion of an old road surface by scarifying to a depth of 6 in., some 3 in. of oiled surface and 3 in. of granular subgrade. With this scarified mixture, a soil-cement base was made, using three percent cement by weight. With a plant-mix asphaltic surface, this road is now satisfactorily taking heavy logging loads.

Resurfacing old concrete

Successful results of salvaging old scaled or broken concrete pavement were attained in Ohio. A dense graded plant mix is used for resurfacing with the thickness varying according to the amount of traffic and the amount of scaling. A thickness of 4 in. has been used in Ohio for heavy truck traffic and 2 in. for medium to light traffic, and the resultant life of the new surface has been 12 to 15 years. The cost per mile in Ohio for resurfacing a two-lane highway with a 3-in. coat of plant mix was $18,000.

Mr. Hathaway recommended resurfacing before the old pavement gets too bad. By so doing, he said, better results can be attained. He further said that an asphalt cover seals the surface and thus reduces the difficulties due to pumping action at the joints in concrete pavement. R. M. Gillis of California reported that when resurfacing concrete pavements that have rocking slabs, 3 in. of new surfacing is not enough if the rocking is severe. In this case, he suggested a covering of 6 to 8 in. of crushed rock and then a 3-in. asphalt surface.

Speedy Repairs Save Waco Dam Spillway

Cyril S. Adams
Cyril S. Adams, Inc.
Houston, Texas

***Contents in Brief**—Extensive erosion of the shale foundation underlying the apron of the spillway of Waco Dam caused not only the destruction of the entire apron but also carried away great quantities of foundation material. Refill of the damaged section was carried forward rapidly to preclude any downstream movement in the dam. This work was done in large "steps", the concrete being delivered by chutes from the roadway above the spillway. The new apron, located about 20 ft. below the original, was made considerably heavier and longer. The entire project was completed in less than 40 days.*

REPLACEMENT of a large volume of the spillway and the reconstruction of a reinforced concrete apron were the two essential items in the rehabilitation of the Lake Waco Dam in Texas. In particular, refill of the damaged spillway section was carried forward with the greatest speed to stave off imminent destruction threatened by the instability of the undermined structure.

The dam, containing a gated concrete spillway of gravity design and non-overflow earth sections, was built between 1928 and 1930 for the Waco city waterworks.

Large flood flow

The surface run-off not required for storage is released over the spillway, which is surmounted by sixteen tainter gates, each of which is 15 ft. high and 25 ft. long. The gate piers, fifteen in number, are each three feet thick so that the overall effective length of spillway is 445 ft. The spillway crest is at El. 415, and the top of gates is at El. 430. The original horizontal apron was at El. 373. In its sixteen-year life this spillway has accommodated many large floods, and on several occasions all of the gates have been fully opened to allow the passage of as much as 88,000 sec.-ft. That this amount of water could be very distructive is indicated by the fact that its energy is in the neighborhood of 300,000 hp.

This falling water eroded a large volume of the laminated shale immediately downstream from the spillway. Even though the original construction placed the apron seventeen

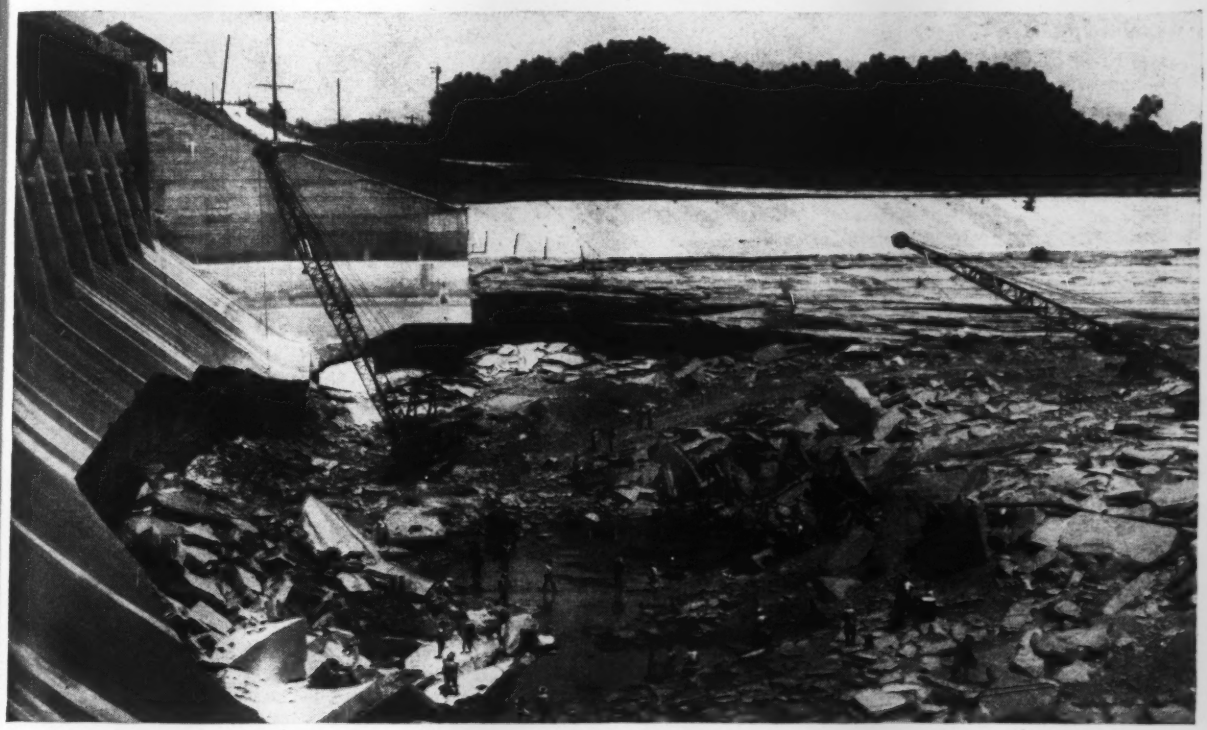


Fig. 1. Erosion caused complete destruction of the apron and part of the overflow section of Waco Dam.

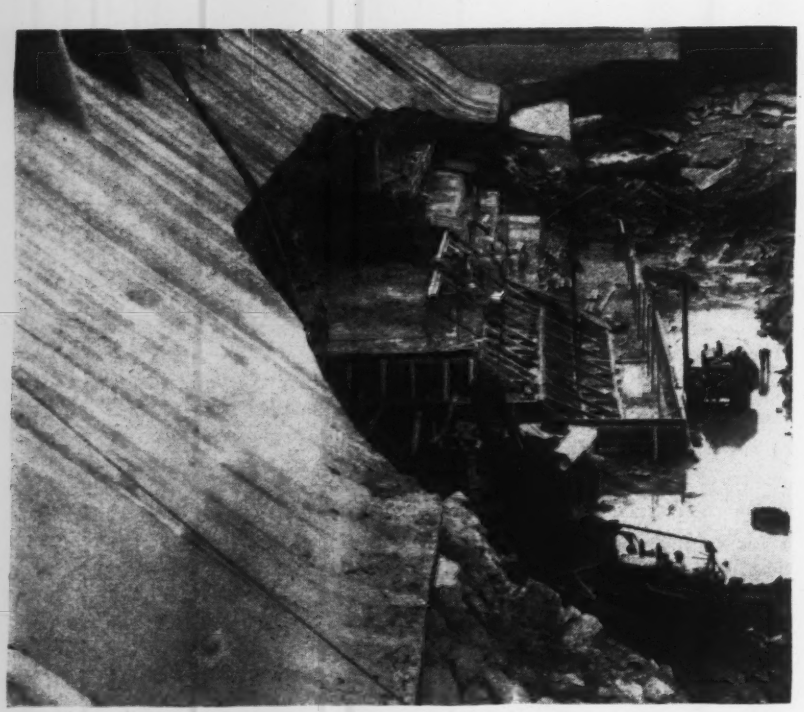


Fig. 2. Repairs to the gravity section were made immediately to preserve the structure, construction being carried forward in stages as fast as the debris was cleared away.

ft. below the surface of the shale in the discharge channel, erosion continued progressively upstream from the apron edge to such an extent that the complete apron eventually was undermined and lost along with as much as 22 ft. of shale vertically below the original apron. A total of 50,000 cu.yd. of concrete and shale probably were lost in this process. Furthermore, disintegration of the foundation had proceeded to the point where failure of the spillway structure by overturning or by sliding was imminent.

The extent of the damage to the original apron and the shale foundation may be seen in Fig. 1. An examination of the damaged sections revealed that the resultant of all forces, in each of the three assumed loading conditions, passed outside the middle third of the base, thereby increasing the unit toe pressure to a dangerous value, and provoking the tendency of the structure to slide. This particular study was made immediately to determine the structural stability of the spillway at the time of the investigation.

Since the downstream area required unwatering for performance of repair work in the dry, and since removal of tailwater made the stability problem even more critical, a further study of the intensity of the forces to apply during construction was required. As a result of this stability study involving three stages of water in the reservoir, the decision was made to lower the reservoir water surface from its normal level to El. 421, and then, to unwater the downstream area as a unit. Thereafter, repair reconstruction was rushed in view of the precarious nature of the structural situation and the ever-present possibility of floods.

The accompanying photographs clearly show the condition of the spillway at various stages of operations. The downstream area after dewatering is shown in Fig. 1, where the hazardous condition of the foundation is evident. Further, note that the apron which originally extended to the downstream limits of the training wall (in the background) has been entirely removed as well as tremendous quantities of base material.

Destruction of structure imminent

The central portion of the spillway, 150 ft. in length, was in such a precarious condition that every effort was made to place a large mass of concrete in this portion of the foundation with utmost speed. The manner in which steps were built against the face of the rock wall immediately under the central section of the dam is shown in Fig. 2 and the new concrete is shown in Fig. 3.

The new apron—placed downstream from the new concrete mass—protects the dam from further undermining and permits the discharge to be guided to the point of release from the concrete surfaces. This apron was designed as a structural unit with a thick downstream cut-off wall and with reinforcing steel arranged to retard erosive disintegration. The entire apron, extending 23 ft. downstream from the limit of the original apron, was based along three elevations to coincide with the strata of sound shale found along the longitudinal profile. A continuous valley

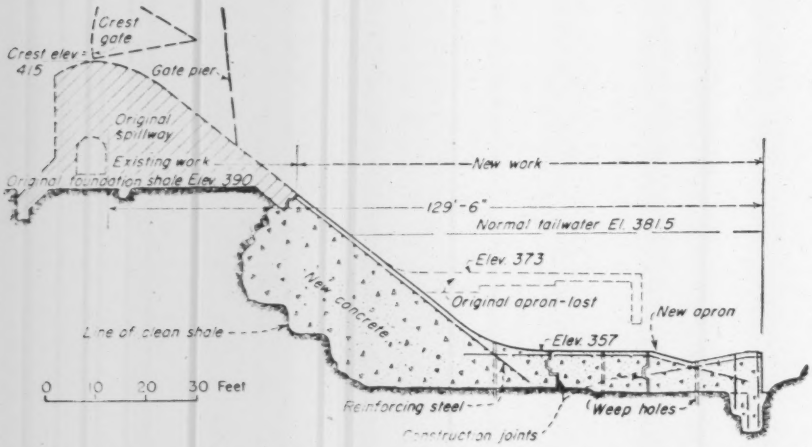


Fig. 3. The extent of the destruction and the location of the rebuilt section are shown in the vertical section through the spillway.

was built into the apron along its downstream edge to turn the stream of water moving along the bottom of the deep stilling pool upward through the pool for dissipation of its energy, an innovation especially incorporated to prevent erosion below the apron during low flow.

Construction progress

Construction progressed vigorously around the clock for seven days a week unitl the project was completed in slightly less than 40 days.

During this period the reservoir surface was held near EL. 421 and excess water was diverted around the spillway through a 48-in. main normally used to supply water to the city.

At the beginning of the work-period, intensive rain on the reservoir watershed caused a spillway discharge resulting in the loss of three days of construction time. No other delays resulted from excessive stream run-off.

From the engineering standpoint, design of the repair work was governed by the portion of the structure that was intact and by the foundation conditions and topography revealed after dewatering and cleaning. The general features incorporated into the spillway may be noted in Fig. 3, which represents the cross-section near the center line. These features, evaluating all conditions and findings, insure a safe and economical structure.

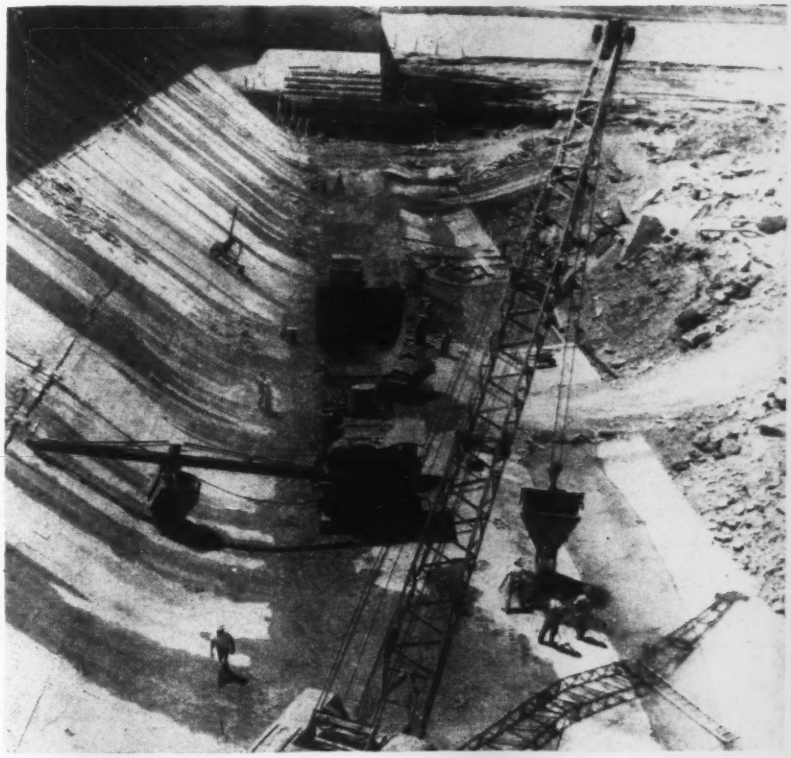


Fig. 4. New apron at a lower elevation protects the dam foundations from future erosion by effectively guiding the spillway discharge into the stilling pool.

For the Waco City Water Works, Hubert G. Davis, superintendent, was in charge of this project. Brown & Root, Inc., contractors of Austin and Houston, performed the construction work with W. M. Powell as project manager, and G. C. Whiteside as job superintendent. Consulting engineer for the project was C. S. Adams, with J. J. Davey as resident engineer.

St. Louis and Toledo Act to Cure Blighted Areas

Long-range plans to supplant slums and smoke with sunlight and orderly residential and commercial development were revealed recently in two more major cities—St. Louis and Toledo.

The American Society of Planning Officials reports that the number of localities with master plans is increasing rapidly, with these two cities becoming latest additions to the lengthening list of municipalities acting to prepare far in advance for urban redevelopment and growth.

The St. Louis plan, recently submitted to the city council by the plan commission, emphasizes means to cure the No. 1 urban disease—blight, which municipal officials say has attacked or threatens half the city. Blighted or near-slum districts cost St. Louis $4 million a year more to maintain than they yield in tax revenues, a condition which weakens the entire local economic structure.

The masterplan calls for rehabilitation of these "sick" areas through a new zoning ordinance which would stimulate more even distribution of population, permit construction of garden-type apartments to replace slums, and rejuvenate the local "circulatory system" with an improved system of streets and expressways. The plan provides also for 35 airports in the metropolitan area.

Zoning regulations now effective in St. Louis, according to city officials, provide too much land for commercial use, with the result that residences are either crowded together in the remaining city area—forming slums—or are forced to locate in the suburbs, beyond municipal taxing and zoning jurisidiction. This sets up a vicious cycle of more slums and more haphazard "fringe" growth.

Planners in both St. Louis and Toledo call for stringent enforcement of smoke-abatement regulations. Master plans of both cities provide also for concentration of manufacturing in special industrial areas, modernization of business districts through development of off-street parking facilities, expressways for bypassing trucks and through traffic, and improvement and strict enforcement of traffic control measures.

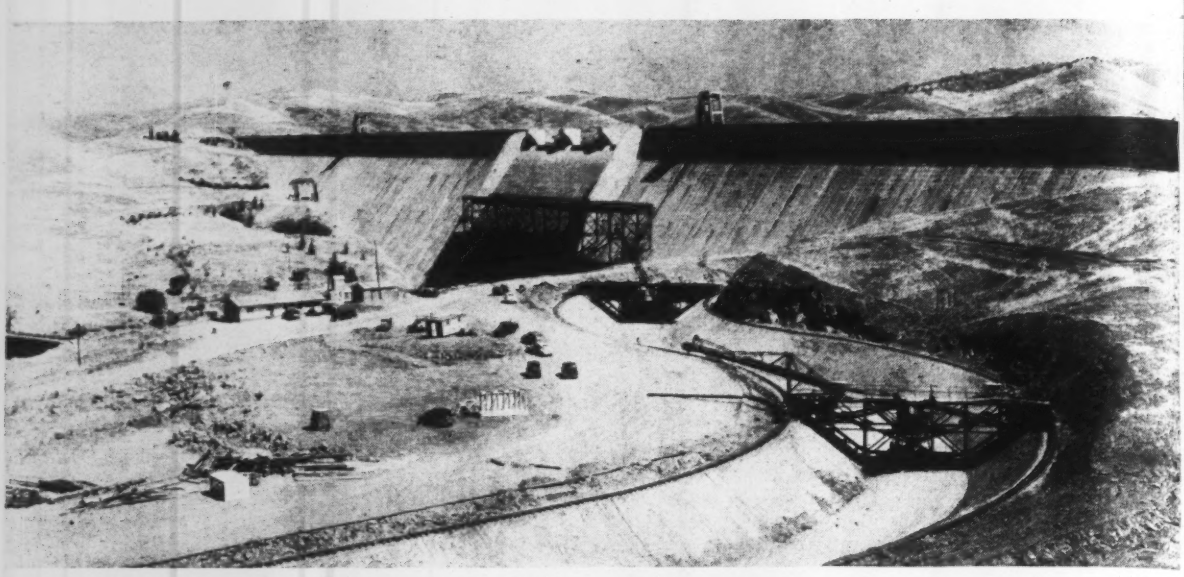


Fig. 1. Friant Dam is complete except for three drum gates on the spillway. Friant-Kern Canal is in the foreground.

Central Valley Project—Canals Come Next

***Contents in Brief**—With completion of major work on Shasta and Friant dams, emphasis on the Central Valley project in California has changed to construction of long, large-capacity canals. On the basis of funds expended, less than half of the project as authorized by Congress has been completed. Some parts are now in operation, but the major function of the project—that of diverting water from the Sacramento Valley in the north for use in the San Joaquin valley in the south—cannot be performed until 1949 at the earliest. Progress to date and future plans are outlined.*

WARTIME CURBS on nonmilitary construction necessarily slowed progress on the Central Valley project of California. However, construction is now underway on several parts of the work, particularly on two major canals which, when completed, will bring into operation the major irrigation features of the project. Since 1937, some $170 million has been spent on the projects, and to complete the initial features an estimated $215 million more will be required. A summary of progress to date and an outline of future plans is presented in the following.

Construction of the principal project features such as Shasta Dam and Friant Dam have been described in detail in previous *Engineering News-Record* articles. The interrelation of all parts of the project as planned when initial construction started was described in *ENR* Aug. 26, 1937, vol. p. 344. However, a brief review of the function of various elements of the work is included here to bring the record up to date.

The primary irrigation purpose of the Central Valley project is to counteract seasonal and geographical maldistribution of water in the large area of arable land comprising the Sacramento and San Joaquin valleys of California. Rain in this area falls almost entirely during the 6-month rainy season and varies upward from the 10 in. per year average, which falls in the southern part of the basin. The 6 months without rain provides a long growing season for properly irrigated crops.

In addition to the seasonal variation, the area is subjected to a geographical variation in water distribution. The Sacramento valley has two-thirds of the water and only one-third of the good farm land, and the San Joaquin Valley has one-third of the water and two-thirds of the good farm land. Solution to the problem raised by this condition, as envisioned by early engineers, is to store run-off from winter rains and spring thaws and to transport each year's excess flow from the Sacramento to the San Joaquin valley. Shasta and Friant dams serve to store water on the Sacramento and San Joaquin rivers, respectively, for this purpose.

General features of project

Water stored by Friant Dam will be distributed by the Madera Canal to the north and by the Friant-Kern Canal to the south. The water thus diverted belongs in accordance with prior rights, to water users whose land is near the San Joaquin River below the dam. Therefore, these users must be provided with a new supply before diversion at Friant can be made.

The Delta-Mendota Canal will, in addition to supplying Sacramento Valley water for use in a large area on the western side of the San

Joaquin, take water from the delta region formed by the confluence of the San Joaquin and Sacramento rivers and deliver it to the San Joaquin River near Mendota some 120 miles away. Thus, water flowing down the Sacramento River to the delta region will be taken by this canal to the San Joaquin River to replace water diverted at Friant Dam. Regulation of the flow of the Sacramento River by releases of water from Shasta and Keswick dams will make available in the delta region an ample supply of water the year round for this purpose. Power for pumping will be supplied by generators installed at Shasta and Keswick dams. From the foregoing it can be seen that water cannot be diverted at Friant Dam in quantity until the Delta-Mendota Canal is completed.

In addition to the irrigation water provided, advantages claimed for the project include power development, navigation improvement, flood control and protection of the Sacramento River delta region from salt water intrusion.

Congress has authorized the construction by the Bureau of Reclamation of certain project works originally proposed as the entire Central Valley project. Studies made since the original proposal have revealed, according to bureau officials, the desireability of constructing many other works. To distinguish the group first authorized from these later proposals, those phases of the undertaking first authorized by Congress are classed as belonging to the "initial" phase of the Central Valley project. These initial features include those listed in Table I as well as the following, which are not yet under construction: the Contra Costa lateral system, Delta cross channel, Delta steam plant, and additional transmission and substation facilities.

War reduced work on project

The advent of war curtailed work on the project. Although plans for the canals were prepared, no new contracts were let for work of this sort during the war. However, work was continued that could be helpful to the war effort or that did not require much in the way of manpower and materials. Much of the work on Shasta power plant was done during this period.

When the end of the war neared, the bureau once more started letting contracts for major work. The first Friant-Kern Canal contract was let Aug. 3, 1945, just a few days before V-J day. Since then much progress has been made. Table I shows the status of various parts of the project in the latter part of 1946.

Details of each of these phases of the work are listed in the following:

Shasta Dam and Reservoir—Shasta Dam, the largest and most costly single item of the Central Valley project, is the world's second largest concrete structure. It rises 500 ft. from the floor of the Sacramento River canyon, and when spillway gates are completed will provide reservoir storage capacity of some 4,500,000 acre-ft. Controlled releases from Shasta Dam are intended to improve navigation, prevent salinity encroachment in the Sacramento-San Joaquin delta, supply water for the irrigation of Sacramento valley lands, furnish water for pumping from the delta to irrigate San Joaquin valley lands in exchange for San Joaquin River water, and provide a large quantity of hydro-electric power.

Shasta Dam is now practically complete and is in operation. All that remains to be done are some minor items and the installation of three drum gates on the spillway. The installation of these 110-ft. by 48-ft. gates sometime in 1947 will add the final 300,000 acre-ft. to the reservoir capacity.

Fig. 2. Principal features of the Central Valley project as now authorized. Shasta and Friant dams are almost completed. Activity now is concentrated on the Friant-Kern and Delta-Mendota canals.

Shasta Power Plant—Shasta power plant, partially completed during the war, has space for five 75,000-kw. generators: an ultimate capacity of 375,000-kw. Two of the generators are now in operation. Two more have been built but were temporarily installed in the Grand Coulee power plant to produce additional power for war industries.

The first of the three generators remaining to be installed is to be ready for operation in August, 1947. The other two are scheduled for installation by December, 1947, and May, 1948, respectively. In adddition to the main generators, two station service units of 2,500-kw. capacity each are already installed and in operation.

Friant Dam—Friant Dam, one of the key elements of the project, is located on the upper San Joaquin River some 20 miles north of Fresno, Calif. It will regulate the flow of the river for diversion to the Friant-Kern and Madera canals.

Friant Dam (Fig. 1) is some 283 ft. high and its reservoir, Millerton Lake, will have a capacity of 520,000 acre-ft. The dam is complete and in operation except for spillway drum gates, river and canal outlets, cranes for operating purposes, and some miscellaneous metal work. The drum gates will increase the capacity of the reservoir some 85,000 acre-ft. They will be installed by use of a craneway on the spillway left in place for that purpose.

Control valves now installed at the dam were borrowed temporarily from Boulder Dam. Three replacement and seven additional valves are required to complete the permanent installation for the operation of the two canals and the river outlets.

Contra Costa Canal—The 48-mi. long, 350-sec.-ft. capacity Contra Costa Canal will extend westerly from the Sacramento-San Joaquin delta to provide water for municipal, industrial, and agricultural use in an area along the channel that connects the delta with Suisun Bay. At one time, a fresh water supply was available from this channel, but use of the

Fig. 3. Many miles of the Friant-Kern Canal are now under construction. When operated at capacity, it will convey 4,000 sec.-ft. from Friant Dam to the dry southern end of the San Joaquin valley.

water upstream has caused this section to become saline in content. The fresh-water supply with deep-water anchorage was the reason many industries were located in this area. Because the channel has changed from fresh to salt, these plants must now look elsewhere for their water supply.

Thirty-eight miles of the canal have been completed and are in operation. This includes the headworks and four pumping plants each with 210 sec.-ft. capacity. Contracts have been let, to be completed in 1947, for two more pumping plants and for the construction of a terminal reservoir and some eight additional miles of canal. Power distribution lines to operate pumps on this system are under construction. The lateral system is only partly complete with much additional work yet to be done.

Madera Canal—The Madera Canal is the one irrigation feature of the Central Valley project that is complete. It has a capacity of 1,000 sec.-ft. and extends 36 miles north from Friant Dam, serving one of the richest agricultural areas of the San Joaquin valley. This area, most of which is included in the Madera Irrigation District, contains many prosperous farms which have made money, especially during the recent years of high prices for agricultural products, despite high pumping costs for well water.

Although the Madera Canal is in operation, it is not being utilized to its full capacity. Distribution canals must be constructed and a final contract must be negotiated with the Madera Irrigation District. Until such a contract is made, this district is served under interim contracts which are renegotiated each year. The interim contract for 1946 called for 110,000 acre-ft. of water at 50c. per acre-ft. This was not delivered to individual farmers, but was run down six water courses in the area to raise the water table.

Delta-Mendota Canal—The Delta-Mendota Canal is the largest single item in the postwar construction work on the Central Valley project. On the basis of present prices, it is estimated to cost $71,175,000. This canal will have a capacity of 4,600 sec.-ft. and will extend from the Sacramento-San Joaquin delta some 120 miles south to Mendota. Water supplied by this canal will substitute for San Joaquin River water stored by Friant Dam for diversion by the Madera and Friant-Kern canals.

Two contracts, let in July 1946 for work on this canal (Table II), allow 800 days for completion of the work. Bureau officials hope to let additional contracts during the 1948 fiscal year so that this work can be completed at the time of completion of the Friant-Kern Canal.

The Delta-Mendota Canal will have a trapezoidal section with 1 on 1½ side slopes and will have widths of 48 ft. at the bottom and 106 ft. at the top. As work on the canal has not yet progressed to the canal lining stage, it is not yet known what type of equipment the contractors will use. Canal trimming and lining equipment such as shown in Fig. 1 have not yet been used where the span is as great as 106 ft.

A spectacular feature of the Delta-Mendota Canal is the pumping plant located near the north end of the canal. This plant will lift water some 200 ft. at the rate of 4,600 cfs. Six 27,000 hp. pumps will feed into six steel pipes, each 10 ft. diameter. These 10-ft. pipes in turn feed into three 15-ft. pipes (each pipe taking the discharge from two pumps) which will carry the water about three miles. Initial capacity of the pumping plant will be 3,500 cfs. No contracts have as yet been let for this work.

Friant-Kern Canal—The Friant-Kern Canal is the scene of the greatest construction activity on the Central Valley project at the present time. In Table II are listed the major contracts let. This canal will be about 160-miles long and its capacity of some 4,000 sec.-ft. will be available for water flowing from Friant Dam to the arid and now almost waterless area in the southern end of the San Joaquin valley. This water, however, will not be completely available until the Delta-Mendota Canal is finished.

With the exception of the Delta-Mendota Canal, the Friant-Kern Canal will be the largest lined canal yet constructed in the west. The canal trimmer and the canal liner shown in Fig. 1 have spans of 85 ft. and are 30 ft. deep. At the time this was written, the use of these machines was more or less in the experimental stage and all the "bugs" in them had not been worked out. For example, the trimmer worked well on soft material but was not rugged enough to successfully withstand the jolting and wrenching resulting from unpredictable snags of firm rock. The lining machine has required the use of more hand finishing work than expected. The contractor's engineers hope to make such improvements in the machines as will result in uninterrupted progress as the work goes on.

Keswick Dam and Powerhouse—Keswick Dam, on the Sacramento River just below Shasta Dam is intended to provide an afterbay for the Shasta power plant. It will store water released through the plant so that peak power production for short periods will not interfere with other uses or create a hazard farther

down the Sacramento River. The reservoir capacity is 24,000 acre-ft. and there will be 200,000 cu.yd. of concrete in the dam after final completion. The dam is now finished except for a gap in the right abutment through which a railroad line runs. This gap cannot be closed until permission is obtained from the Interstate Commerce Commission for abandonment of the line.

The Keswick power plant will have a capacity of 75,000 kw. The structural part of the plant building is virtually complete and the three 25,000-kw. generators are scheduled for installation in November, 1947, December, 1947, and February, 1948. However, they will not be operable until the dam, itself, is complete.

Delta Cross Channel—The purpose of the Delta Cross Channel is to divert water from the lower Sacramento River across the Sacramento-San Joaquin delta to points where it will be convenient to the intakes of pumps that will lift it to the Contra Costa and the Delta-Mendota canals. The cross channel will have a capacity of 10,000 sec.-ft. and will be 50 miles long.

Several schemes have been proposed for the construction of this waterway, ranging from the building of a large concrete-lined canal to the simple widening and deepening of some existing channels. Present indications are that certain of the existing channels will be enlarged and a diversion structure will be built to turn the Sacramento River water into the proper channels. No construction work has been started on this feature of the project as Congressional appropriations are required.

Power Distribution System—Of the several portions of the electric transmission system proposed, one part, the Shasta-Oroville line, has been completed and is in operation; a second part, the Oroville-Sacramento line, is now under construction with the work being done on a force account basis by the Bureau of Reclamation. This line is expected to be completed in 1947.

The Shasta-Oroville line is some 100 miles long and has a capacity of 230 kv. At present, a 26-mile length of this line is used to deliver power

TABLE I—CENTRAL VALLEY PROJECT CONSTRUCTION PROGRESS

	Total Estimated Cost	Date Construction Started	Date Placed in Operation	Percent Completed
Features in Operation				
Shasta Dam and Reservoir	$116,324,000	July 28	Dec. 43	93
Shasta Power Plant	18,309,200	Oct. 38	June 44	70
Shasta Switchyard	3,071,000	Sept. 43	June 44	55
Shasta-Oroville Transmission Line	1,245,000	Oct. 43	June 44	100
Friant Dam and Reservoir	20,461,000	July 40	Feb. 44	93
Contra Costa Canal	5,439,300	June 37	July 40	76
Madera Canal	2,575,000	Dec. 40	May 44	100
Features under Construction				
Delta-Mendota Canal	$71,175,000	Sept. 46		5
Friant-Kern Canal	36,834,000	Oct. 45		20
Keswick Dam and Power Plant	15,063,800	Oct. 41		70
Keswick Switchyard	1,745,000	Dec. 46		5
Oroville-Sacramento Transmission Line	1,730,000	Sept. 46		30
Contra Costa Canal Power Distribution Lines	234,000	April 40		31

TABLE II—MAJOR CONSTRUCTION CONTRACTS* NOW IN EFFECT

Description	Contractor	Date of Award	Contract Price
Friant-Kern Canal			
Stations 6 + 10 to 301 + 60	Peter Kiewit Sons Co.	8-3-45	1,163,340
Stations 311 to 1144	Peter Kiewit Sons Co.	3-12-46	3,377,605
Stations 1144 to 1591 + 66.15	Peter Kiewit Sons Co.	4-8-46	1,598,856
Stations 1159 + 66.15 to 1647 + 75	Morrison-Knudsen Co., and M. H. Hasler	6-7-46	1,514,975
Stations 1647 + 75 to 1932 and 2631 to 3876	Arizona-Nevada Constrs.	6-6-46	5,079,976
Stations 1932 to 2631	Morrison-Knudsen Co., and M. H. Hasler	6-6-46	1,829,457
Contra Costa Canal			
Stations 2321 + 25 to 2512 + 00 and Mt. View Dam	Parish Bros.	4-18-46	568,975
Delta-Mendota Canal			
Stations DMC 686 to DMC 1365 and Westley Wasteway	H. H. Everist, Sr.	6-14-46	3,530,068
Stations L 185 to L 774 and Mtn. House Siphon	Morrison-Knudsen Co., and M. H. Hasler	10-25-46	3,025,181

*More than $500,000.

TABLE III—MAJOR RESERVOIRS* AND POWER PLANTS PROPOSED FOR FUTURE CONSTRUCTION

Feature	Stream	Reservoir Capacity acre-ft.	Power Plant Capacity kw.	Estimated Cost 1940 Prices
San Luis Res.	San Luis Cr.	816,000	.....	$28,000,000
Pine Flat Res. & P. P.	Kings Rv.	1,000,000	45,000	23,000,000
Monticello Res. & P. P.	Putah Cr.	2,200,000	25,000	16,700,000
Folsom Res. & P. P.	American Rv.	1,000,000	60,000	44,400,000
New Melones Res. & P. P.	Stanislaus Rv.	1,100,000	48,000	32,800,000
Black Butte Res.	Stony Cr.	160,000	.....	5,800,000
Isabella Res.	Kern Rv.	550,000	.....	8,700,000
Terminus Res.	Kaweah Rv.	145,000	.....	7,700,000
Success Res.	Tule Rv.	115,000	.....	7,100,000
New Hogan Res.	Calaveras Rv.	325,000	.....	7,000,000
Bidwell Bar Res. & P. P.	M. Fk. Feather Rv.	1,200,000	104,000	62,000,000
Indian Valley Res.	N. Fk. Cache Cr.	250,000	.....	3,300,000
Nashville Res. & P. P.	Cosumnes Rv.	550,000	18,000	15,000,000
Hidden Res.	Fresno Rv.	90,000	.....	5,300,000
Table Mountain Res. & P. P.	Sacramento Rv.	500,000	45,000	30,110,000
New Bullards Bar Res. & P. P.	N. Fk. Yuba Rv.	675,000	60,000	38,000,000

*Larger than 100,000 acre-ft. reservoir capacity or costing more than $5,000,000.

from Shasta to the Pacific Gas and Electric Co. The remaining 74 miles is leased to the power company for interconnection with its high voltage lines.

Construction of power transmission facilities by the Bureau of Reclamation in the Central Valley has been the subject of much controversy. Funds for the construction of some of the proposed facilities have not been appropriated and were the subject of much congressional discussion during the 1946 session.

The proponents of power line construction by the bureau claim that without such lines the government will be forced to pay rental for the use of privately owned facilities. In such manner the profit made by the utility owning the facilities rented would increase the cost of water to the ultimate consumer. The claim is also made that commercial power available at Shasta and Keswick dams will have to be sold to a private utility company and its cost to the ultimate consumer would thus also be increased.

Opponents of the construction of transmission lines by the government claim that facilities for such transmission already exist and to duplicate them would be a needless expense. Some also claim that the relative inexperience of government engineers in locating, building, and operating thees power lines will make the ultimate cost just as high as if the power were sold to a privately owned utility.

Delta Steam Plant—One more part of the Central Valley project that has been authorized by Congress but for which no appropriations have been made is the Delta steam power plant. This plant is to be located near Antioch, Calif., a few miles from the Delta-Mendota Canal pumping plant.

This plant is intended to supplement the output of the Shasta and Keswick power plants during periods when water supply is insufficient for power purposes. Without such a steam plant, the firm energy produced by the Shasta and Keswick plants will be only about 780,000,000 kw.-hr. annually. By adding the Delta steam power plant to the system, it is claimed that the firm energy capability will be increased to about 2,350,000,000 kw.-hr. annually. Construction of this plant has not been started as no money has been appropriated for construction.

The Central Valley project, as are other projects built under the terms of the Reclamation Law, is subject to the "acreage-limitation" provisions of that law which, according to R. L. Boke, Director, Region II, Bureau of Reclamation, limits "the fair amount of water one man may receive from a public project." Such a limit has been the subject of much controversy and has been misunderstood by its proponents as well as its opponents. One of the main causes back of this controversy is the total acreage in the hands of owners holding land in excess of the area-limitation rules. More than 33 percent of Central Valley project land, according to results of a recent USBR survey, is so owned.

Acreage limitation

The law limits to 160 acres—or 320 acres in case of man and wife in a community property state such as California—the amount of land for which one person can receive water. It does not require landholders to sell lands owned in excess of the limitation. Mr. Boke in a statement has said that a farmer must designate the 160 acres of his land for which he wants to receive water. Any other land which he owns must be irrigated from other sources—in most cases by pumping from wells, which will be more expensive.

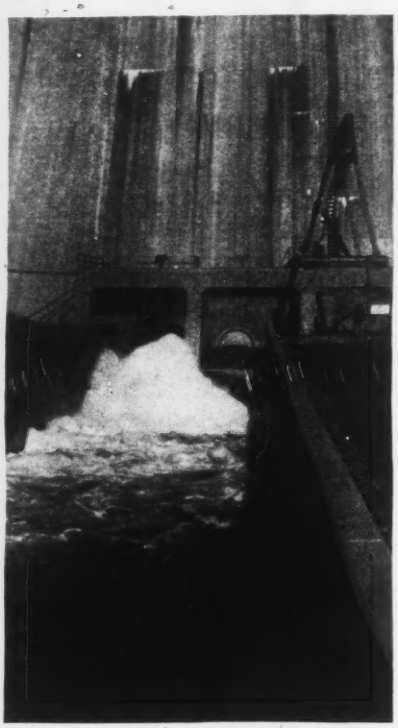


Fig. 4. Here water leaves Friant Dam headed for rich farm land to the north through Madera Canal, one of the irrigation elements of its project now in operation.

Because of the acreage limitation, some of the more prosperous districts in the area that the project is designed to serve have not signed long term water contracts with the Bureau of Reclamation. This in spite of the fact that project water will be cheaper than pumping from below a watertable that even in such areas is 60 ft. or more below ground. Part of this failure to come to terms on contract provisions is attributed by some people to the conservative nature of farmers which makes them suspicious of outsiders and afraid that such contracts would be the opening wedge for government control of their business. They are said to feel they have done all right to date on their land which, in some parts of the San Joaquin Valley, ranks among the most productive farm land in the United States according to dollar value of products per acre.

Service problems increased

In areas containing both participating and non-participating farms (*i.e.* non-participating in irrigation benefits because of acreage owned in excess of limitations), service will be difficult. Laterals must be built around instead of through non-participating farms or a fee for severance damages must be paid. Besides this, non-participating farms will benefit without paying for benefits. Use of water for irrigation purposes by, say, 80 percent of the land in a district (approximate figure for one actual case) would raise the watertable. As a result, non-participating farms would benefit by reduced pumping costs.

In regard to the limitation rules, some say that it is their understanding that the project was designed on the basis of almost 100 percent participation. They further say that with only part of the land using water, either the cost of water to the participants will be increased or the repayment of the project costs will not be accomplished in the time prescribed by law.

Opponents of the acreage limitation claim that, with modern farming methods, which require expensive machinery, it is more economical to work larger acreages. They claim that such a limitation will result in higher prices for farm produce with less profits.

However, Reclamation Commissioner Michael W. Straus in a report on land ownership surveys on federal reclamation projects recently stated that with adequate water supply, yields are increased and smaller-scale operations become more economical. This in turn, he said, makes increased settlement on such land possible, giving more citizens opportunity to benefit from federal investment in irrigation.

Congressional action sought

California's Senator Sheridan Downey has announced that he intends to introduce legislation in Congress specifically excepting the Central Valley project from the acreage-limitation provisions of the Reclamation Law. In doing so he cited other reclamation projects exempted from these provisions by act of Congress.

One such act, which concerned the Colorado-Big Thompson project, made the excess-land provisions inapplicable to lands "which now have an irrigation water supply from a federal reclamation project and which will receive a supplemental supply from the Colorado-Big Thompson project."

It was said in support of the exemption that on lands already settled and irrigated there is no practical need for establishing the size of farm units and protecting settlers against the danger of land speculation. As a good part of the Central Valley project lands are settled and irrigated, those favoring its exemption from excess-land limitations believe the reasoning behind Colorado-Big Thompson exemption is applicable.

Proposed work

The Bureau of Reclamation has for the past few years made studies of the Central Valley area to prepare plans for its complete development. Many streams tributary to the Sacramento and San Joaquin rivers are only partially developed. Sizable flows almost all year round enter from these streams on the eastern side of the valley, which drain the Sierra Nevada. Development, according to the bureau's plans, would insure a sufficient and continuing supply of water to the nearly 2,000,000 acres now irrigated, and allow some 3,040,000 additional acres to be irrigated. The Central Valley has much additional rich land, topographically suited for irrigation, which will never be irrigated, even if every drop of Central Valley water were used.

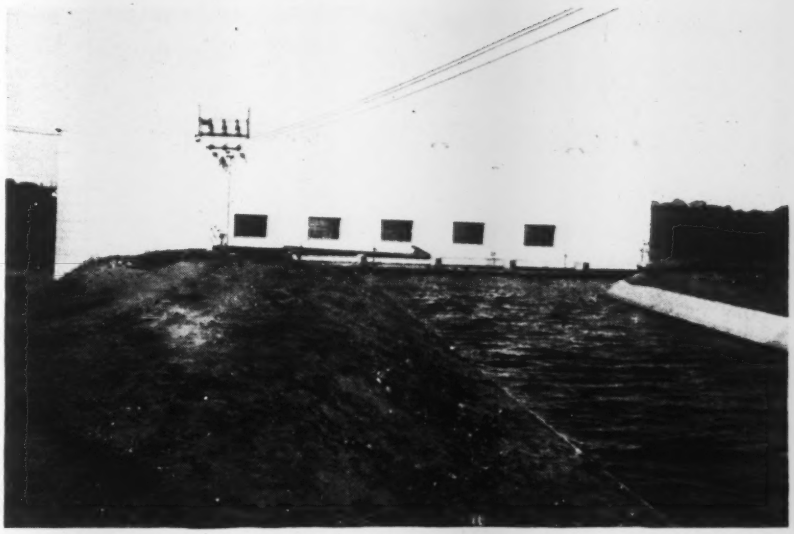


Fig. 5. Although as yet only partly completed, the Contra Costa Canal is already in operation. It is here shown filled with water above one of the four completed pumping plants; each of the latter have a 210 sec. ft. capacity.

Other benefits to be derived from such complete development are in proportion to the irrigation benefits. Total cost is estimated to be some $1,800,000,000.

The bureau's proposed plan includes, in addition to the initial phase, the construction of some 38 major dams and reservoirs and the power facilities, canals and other control works for the beneficial use of the water resources. Listed in Table III are some of the major proposed reservoir and power plant projects. The first nine (down to and including Bidwell Bar) are listed by the bureau as recommended for postwar construction (1946-1960 proposed program) and the remainder are listed as available for postwar construction (ultimate program).

Many of these projects have also been proposed for construction by the Army engineers with emphasis on flood-control and navigation features and in some cases different reservoir capacities and locations. For example, the Army Engineers' proposed Iron Canyon reservoir project is being considered as an alternate project to the construction of Table Mountain reservoir by the bureau.

In appropriating money for construction by the Army Engineers of a project on the Kings River, Congress added provisos that are intended to insure the application of federal reclamation policy to that project. At the direction of President Truman, the Bureau of the Budget held up the use of funds so appropriated pending "determination of the allocation of costs and the making of the necessary repayment arrangements." In so doing, the President issued a statement referring to his recommendations regarding an overall plan for the development of the water resources of the Central Valley area. He stated that he hoped Congress would adopt the plan "to put an end to a situation which, in California and in Washington, has been productive of administrative confusion as well as confusion to the general public."

The confusion between the USBR and the Army Engineers referred to by the President was reported in *ENR* Sept. 13, 1945, vol. p. 399. At that time it was suggested that a "policy" decision by Congress might be necessary. To date no such ruling has been forthcoming to clarify the relationship in such matters between the two agencies.

Free Residual Chlorination Improves Water Quality

MAINTENANCE of free residual chlorination has been found highly desirable as a means for improving the quality of water as well as safeguarding this quality throughout the distribution system. This conclusion has been reached by the Department of Health in Michigan where 45 towns supplying water to 3,000,000 people employ this method.

Results of the use of this process were discussed by Raymond J. Faust, chief engineer of the Michigan Health Department, at a meeting of the American Public Health Association. He pointed out that free residual chlorination—the application of chlorine in amounts sufficient to oxidize all organic matter as well as provide a "free" or uncombined surplus of chlorine in the water—results in superior bactericidal action, improves taste, odor and color removal, eliminates after-growths in the distribution system, and inactivates the virus of poliomyelitis. Moreover, the process is especially successful in small plants where treatment facilities are inadequate.

Experience has shown that the use of free residual chlorination is superior to that of chlorine-ammonia treatment. In one case a chlorine application of 6.6 to 7.1 ppm. removed severe taste and odors from industrially-polluted waters in the Detroit area where chloramine treatment had failed to do so. This accomplishment was rewarded by an immediate cessation of consumer complaints.

In other instances, chlorine—supplied at the rate of 15 to 30 ppm. to handle heavy organic loadings—improved taste and removed odors after all known methods had been tried without success. Treatment of a small supply containing luxuriant algae growths with 4.5 to 5.5 ppm. of chlorine produced a pleasantly palatable water entirely free of coliform organisms.

Reaction on poliomyelitis virus

Studies of the 1944 epidemiological records of two towns tended to indicate that drinking water, under certain conditions, might have spread poliomyelitis virus. Although the virus has never been found in drinking water, it has been isolated from sewage. As published data implied the failure of present water treatment methods to combat the virus, a field experiment to test the effectiveness of free residual chlorination in this respect was undertaken. Simultaneously, a controlled study by the Bureau of Laboratories of the Michigan Department of Health, was conducted to determine the effect of free residual chlorination on the viability of the "polio" virus in water. The preliminary report of this work (*Jour.*, American Water Works Assn., vol. 38, No. 9, Sept. 1946, p. 1069) revealed that after contact with free chlorine for one-half hour, no active virus was detected in the samples.

As a result of these findings, Dr. William A. DeKleine, Michigan's commissioner of health, recommended that free residual chlorination be adapted at water treatment plants throughout the state. Cooperation has been widespread; all of the larger plants in the upper peninsula of Michigan now use this method of sterilization.

Operational experiences

Benefits of free residual chlorination are best obtained by pretreatment, stated Mr. Faust. As a result of extended contact in settling basins thorough oxidation of organic matter may be effected. For example, destroyed algae is almost completely removed in settling basins with the use of coagulants. Such treatment also extends filter runs. In Flint, inefficient settlement of luxuriant growths of *Cyclotella* caused plugged filters and runs reduced to one hour. Application of chlorine sufficient to kill algae improved sedimentation and reestablished normal filter runs.

Success of any water treatment depends largely on its effect on tastes and odors. Experience with free residual chlorination in Michigan clearly indicates that tastes and odors of water are improved and that in no case are results inferior to those obtained by previous treatment methods.

Free residual chlorination practice is not a panacea for all troubles, cautioned Mr. Faust. Although excess chlorine can oxidize phenol-contaminated waters, it does not provide a completely satisfactory solution. Chlorine dioxide is preferable. Severe algal growth presents taste and odor problems not entirely solvable by this method. However, the possibilities of improving taste and odor by use of free residual chlorination are sufficiently promising to warrant further exploration.

An interesting advantage of free chlorine is its bleaching effect. In many cases 25 to 33 percent of color has been removed solely by excess of chlorine.

Free chlorine residual has effectively eliminated after-growths in distribution systems; in one instance it eliminated "red water" complaints.

Need for and desirability of carrying a residual of chlorine throughout the distribution system has a basic public health significance. One of the prime reasons for applying ammonia to water is to form long-lasting chloramines. With the introduction of free residual chlorination, the question of maintenance of a residual arose. Fortunately, free residual chlorine is relatively staple and can be carried effectively throughout water systems. Exceptions, of course, are dead ends.

Reduction in costs

Cost of free residual chlorination is usually less than that of other treatments. It generally eliminates continuous need for carbon, especially when tastes and odors are slight. Also, use of ammonia can be discontinued. Chlorine dosages vary from one and one-half to five times the previous amount. Yet, the cost is counterbalanced in most plants by savings in other chemicals.

The Michigan experiences show that free residual chlorination is not an emergency treatment method, concluded Mr. Faust. It is adaptable, provides superior bactericidal action, improves filter runs, aids taste, odor and color removal, and eliminates after-growths in distribution systems. Its ability to inactivate the virus of poliomyelitis in water establishes it as a valuable public health tool. Moreover, its costs compare favorably with older methods of treatment.

Piers Sunk by Open-Well Dredging For Mississippi River Bridge at Memphis

***Contents in Brief**—Main piers in the Mississippi River for a highway bridge at Memphis, Tenn. were sunk by open-well dredging but cleaned out and sealed under pressure of about 43 psi. Willow mats were used at piers in the main channel and caissons were sunk through them. Piers on sloping banks were started on leveled fill inside sheet pile cofferdams while piers on the Arkansas flood plain were worked entirely in the open and sealed without de-watering. Sheetpiles served as part of the cofferdam walls and were withdrawn after masonry of the piers had been built up.*

FOUR of the deep piers for the new highway bridge at Memphis, Tenn., were sunk to as much as 100-ft. below low water by open dredging in sticky clay that had to be broken up by water jets at 400 psi. before it could be removed. After the piers were near final elevation, air at about 43 psi. was put on the pier structures; they were then cleaned out and the foundations poured as pneumatic caissons. Three other piers founded at shallower depths were worked entirely as open caissons with tremie-poured seals.

The present bridge is the third to cross the Mississippi River at Memphis and is the first structure for highway use only. In 1891-94 what is now the Frisco Lines (St.L. & S.F.) built a bridge at the site that for a time carried wagon traffic on a decked roadway on the tracks. In 1912-1915 several railroads combined to build the double-track Harahan Bridge, which accommodates highway traffic with 14-ft. lane roadways cantilevered outside each of the trusses. The two bridges still are in use, but more adequate highway facilities have long been necessary.

The new structure is 200-ft. downstream from the old Frisco Bridge and 400-ft. from the Harahan Bridge. Its piers were placed in line with those of the earlier structures to meet a navigation requirement that all be in line, hence the three main spans of the new structure are the same length as those of the other bridges.

From the Memphis side of the river and extending to Pier V, Fig. 2, the superstructure is a cantilever design supported over four intermediate piers across the main channel. The maximum span is 790-ft.. which includes a 431-ft. suspended truss, while two spans are 621-ft., one anchor arm is 431-ft. and one is 360-ft. Beyond Pier V, but not shown in the sketch are two additional 431-ft. simple truss spans, which are identical with the suspended span of the cantilever. Over the flood plain on the Arkansas shore the bridge had to be designed to fit a plan of the Mississippi River Flood Control Commission for a 40-ft. deep, 1,000-ft.

Fig. 1. Piers for the highway bridge at Memphis line up with those of the Frisco Bridge, center, built 1891-1899, and the Harahan Bridge, at left, finished in 1915, which now carries the highway traffic on narrow roadways outside the trusses.

wide channel enlargement at the bridge site proposed for immediate construction. The enlargement will require extensive alteration of the approach structures of the existing bridges to provide suitable foundations and longer spans.

The new bridge is being built jointly by the Arkansas and Tennessee highway departments and the Public Roads Administration as a free crossing under authority granted the Memphis—Arkansas Bridge Commission. Design and supervision of construction are being handled by Modjeski & Masters, consulting engineers, Harrisburg, Pa. Members of this firm have had a prominent part in building all three of the bridges at the site: Ralph Modjeski was chief draftsman for George S. Morison, who designed the Frisco Bridge, and in 1913 Modjeski was commissioned to design and supervise the Harahan Bridge. He was represented on the work by F. M. Masters who later became a partner and is now the principal of the firm.

Contract for the substructure is held by Merritt-Chapman & Scott Corp., which is making excellent progress and probably will have all work completed to above high water before floods can normally be expected this spring. Unless exceptionally high water or some unforeseeable circumstance intervenes, the main foundations will be finished by early spring, some six months ahead of contract date.

Open dredging and air combined

The seven principal piers were constructed by three distinct methods following suggestions on the design plan, which were adopted and developed by the engineering department of the contractor. Piers II and III, in the main channel of the river, were started as floating caissons and submerged to rest on willow mattresses. By open dredging through wells in the caisson, they were sunk to a suitable clay foundation after which they were cleaned out and completed by pneumatic methods.

Piers I and IV, on sloping banks on each side of the river, were protected in sheetpile cofferdams in which the caisson was started on a sand fill and sunk similarly to the river units. Piers V, VI, and VII, on the flood plain on the Arkansas side, were constructed by setting cutting edges on the natural ground, building up and dredging out to sink the piers by open-dredged caisson methods without use of air. An abutment on the Tennessee side, high above flood water, is on piles.

For Piers II and III in the river and to protect the sloping river side of Pier I, large "mattresses" were woven from willows, weighted with stones and sunk to the river bed to prevent scour. The mattresses, (Fig. 2 and 3), were fabricated from barges moored at the site by tying the willows with wire and attaching them to 36-in. dia. headers, made of 4 to 6-in. willow poles, to which anchor cables are attached.

After a mat was completed men walked over it to deposit 25 to 75 lb. stones on the mat until it was almost ready to submerge. When it was desired to sink the mat, crews working from barges dumped additional stones on it, working upstream and over the entire mat until it was all under water except the upstream edge where it was tied to barges for buoyancy.

Permanent anchor cables for the mattresses were run under the barges to submerged anchors upstream. At a signal, ropes attaching the upstream edge to the barges were cut simultaneously and the loaded mats submerged. Specifications required that the 250 x 320-ft. mats be within 15-ft. of plan location and all were held well within that limitation by careful planning of the anchor location and cable arrangements. (It will be noted from locations shown on Fig. 2 that diffi-

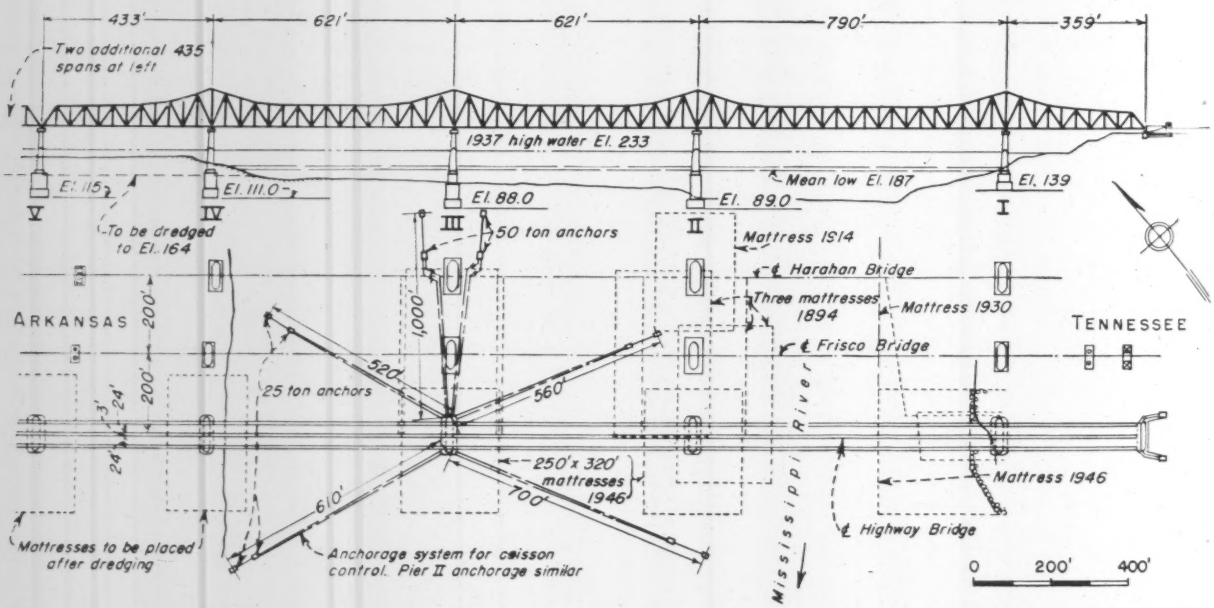


Fig. 2. Elevation and site layout for new Memphis bridge. Piers are founded on firm clay foundation after being sunk through sandy silt and clay. Mattresses are used around the piers to prevent wash. Some of the protection mats from the 1893 work were encountered but those at Pier II of the earlier bridges, where the channel has been cut deeply by water action, were not found.

culty was experienced with positioning the mats for the Frisco Bridge.) After sinking, the mattresses were loaded with 2 ft. of 50 to 250 lb. stones to prevent wash of silt up through the willows and possible subsequent loss of the mats.

Cofferdam built on caisson

The cutting edge and bottom section of the caissons—94 x 44 ft. for Pier II and 94 x 38 ft. for Pier III—were assembled on skids along the shore with fourteen 8-ft. dia. dredging wells formed in them. Welded watertight, the bottom 20-ft. of Pier III and 26-ft. of Pier II were launched as a vessel.

While the caisson was floating a cofferdam was built up to above expected high water level. Around heavily braced welded structural rings I-beams were set vertically at 3 ft. centers and covered with 3-in. T & G timbers laid horizontally and framed tightly together. Over this, a tar impregnated reinforced paper, painted with a bituminous material and protected by 1 x 8 in. shiplap made an almost watertight structure. Dredging wells were extended upward the full height of this cofferdam as air-tight 8-ft. dia. steel shells that later were capped or utilized for air locks when the caisson was put under air.

Meanwhile, work platforms 115 ft. long by 24 ft. wide were built at Piers II and III between the Frisco Bridge and the location of the corresponding pier of the new bridge. Water depth at Pier II was such that piles for support of the platform had to be 110 to 140 ft. long, so 18 in. pipe piles were used, driven open and not filled for the temporary use contemplated. Wood piles were adequate in the higher ground at Pier III. The work platform itself served as a stiffening frame for the piles and as an accurate pile guide for driving. The rigidly framed 16-ft. deep platforms were built on a barge, and then set in the water and moored at the required location. Piles were set through prepared "wells" and driven, after which the platform was raised on the piles to above expected high water and fastened at this level.

Four 50-ton blocks of concrete were set as anchors 1,000 ft. upstream and two 25-ton anchors on each of four lines were used at the sides to control lateral movement of the floating caisson, Fig. 2. Hoists located on the work platform were arranged to supply a pull through 4-part blocks on the anchor lines.

Concrete was poured into the floating caisson to submerge it to the maximum water depth available and a tug moved the caisson into position where connections to the anchor lines were made and the unit positioned exactly. Further load was put on the caisson by adding concrete to force it to settle solidly on the mattress.

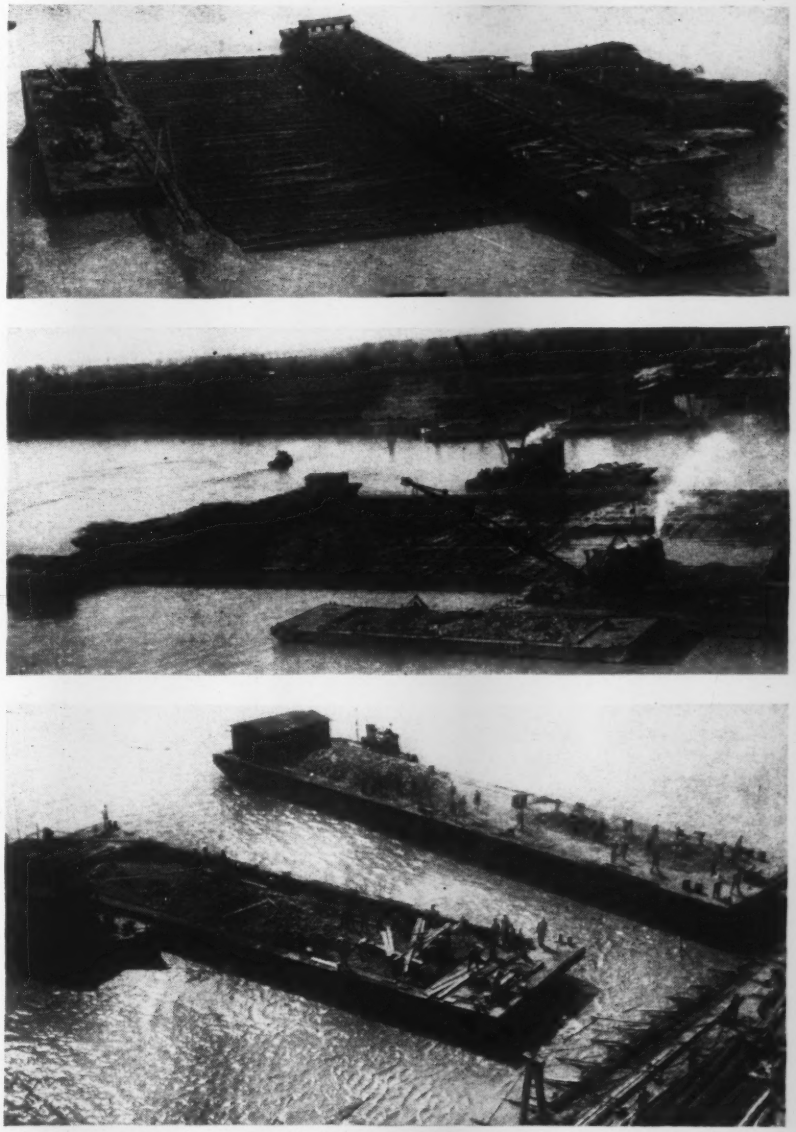


Fig. 3. Mattresses were woven at the site from willow poles tied together with wires. When completed, the mattress was loaded uniformly with stones. When the time came to submerge the mattress, barges moved over it as workmen spread additional stone until only its upstream edge was above water. With permanent anchor lines under the holding barge the manila lines to the mattress were cut simultaneously to allow it to sink.

A long 36-in. beam with one end beveled to a knife edge was used to cut through the mat around the box, and dredging was carried on through ten of the 8-ft. dia. wells. The other four well-openings were reserved for equipment necessary for air work. Three conventional material locks were used, while the single man-lock had two chambers for entering and leaving, with an elevator to eliminate the 125-ft. climb out of the caisson.

Successfully dredging with clam-

shell or orangepeel buckets handled by floating full-revolving derricks is credited by the contractors with being the idea that gave them an edge in the bidding and with keeping the job on a rapid schedule with a minimum of labor. Piers for both of the earlier bridges were sunk entirely by hand excavation in pneumatic caissons as were many of the other piers that have reached good bearing along the lower Mississippi.

Starting to dig with the buckets is slow, tedious work, but once the sandy clay starts to shear and move under the cutting edge, excavation is reasonably rapid. Water at 400 psi. pressure delivered through a 1¼-in. nozzle on the end of a 4-in. dia. pipe was used through the dredging wells to break up the sticky clay and speed the digging.

Caps over the several well openings were designed to be used—and were used—to control the rate of sinking and position of the caisson.

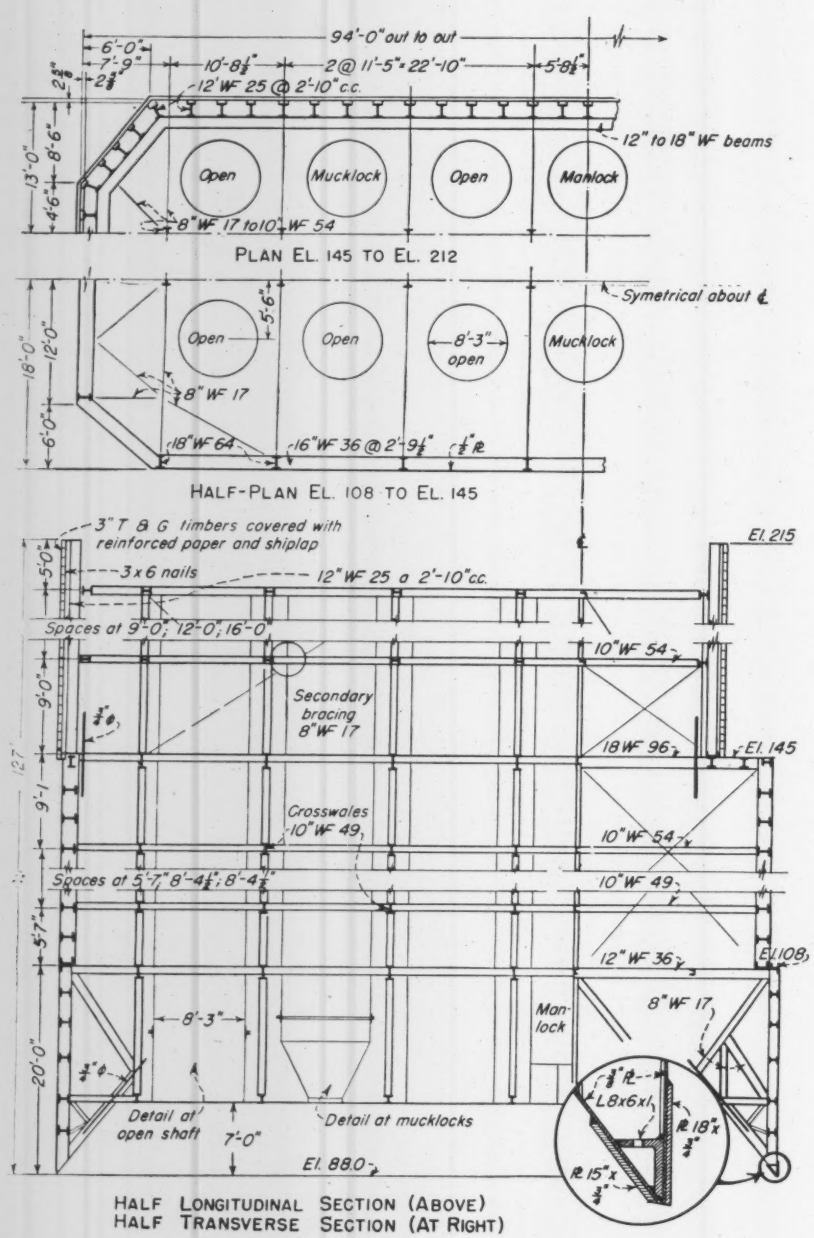


Fig. 4. Cutting edge and caisson for Pier III. The cofferdam section above El. 173 was removed after the pier was completed to above its top.

By closing the wells at one end or one side of the caisson and introducing a small amount of air pressure while digging the other side, the box could be tilted or even moved horizontally with little difficulty. But only experience in similar soil can be used as a guide to just what to expect from such manipulation.

Air up to 43 psi.

Concrete was poured inside the caisson to provide the weight required to sink it as excavation proceeded. When the caisson reached the good strata of clay on which it rests permanently, the open dredging was stopped and domes put over the wells to permit completion as a pneumatic caisson. At the depth of about 100 ft. below low water, at which the caissons were founded, pressures of about 43 psi. were necessary. Under this pressure the sandhogs worked 1-hr., required 40-min. decompression time and returned after 4-hr. for a second 1-hr. trick in the work shift. Pneumatic-operated clay spades were used to cut up the clay, which was loaded by hand into small muck buckets for hoisting to the surface where it was dumped into the river.

After the bottom of the caisson was cleaned and leveled, concrete was placed through the materials locks to fill the work chamber and a little way up in to the dredging wells. The shafts of the wells are left open permanently. After the seal concrete hardened, the 8 ft. 3 in. dia. steel shafts used inside the pier caisson for material and worker access were removed to the level of previously placed concrete at about El. 173.0.

Next operation was to pour a "distribution block" over the caisson top to support the granite faced pier. This 7.5-ft. thick block was designed for placing exactly on plan alignment and elevation, correcting any deviation in location of the caissons. However, all piers are almost exactly vertical and are well within the 6 to 9 in. horizontal tolerance allowed.

Facing used as a form

Granite was set as a face form, and concrete placed inside it in two-course lifts of 5 to 6 ft. of height. As the concrete rose, the vertical beams of the cofferdam were blocked with wood against the pier, and rings of steel bracing removed successively

from the bottom. When the pier was completed to above high water the bottom of the vertical columns of the cofferdam were cut loose from bolts that held them to the caisson, and thus were salvaged in large panels.

Piers on sloping bank

Cutting edges for Piers I and IV, on sloping banks on opposite sides of the river, were set up in sinking location inside a sand-filled single-line sheetpile cofferdam that served as protection against high water. Water tightness of the cofferdam was not required.

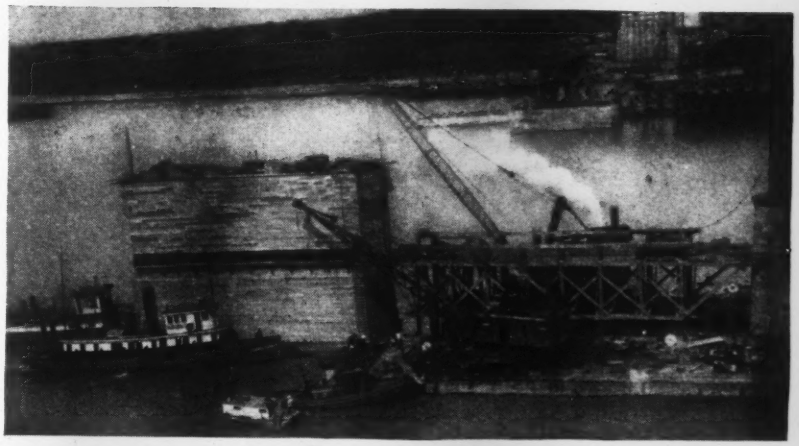
The 20-ft. high caisson and cutting edge was built up in place, again with open dredging wells, and excavation carried on in the same way as for piers II and III though not to as great a depth. These piers also were completed as pneumatic caissons with the final cleaning and concreting work done in the dry.

An innovation was used here in providing protection for masonry work required to some distance below the low water line. Sheetpiles were used as a single-wall cofferdam around the stone encased section of the pier above the caisson section. Alternate sheets were bolted down to prevent upward movement from friction as the box was lowered by inside excavation. Rings of steel waling reinforced the sheetpile cofferdam.

As the masonry-encased concrete pier was built above successive steel rings the sheetpiles were braced against the pier and bracing rings removed. After completion to above the water surface it was only necessary to remove the hold down bolts on the inside of the steel sheets, which could be done in the dry and open cofferdam, then fill with water to equalize the pressure and pull the sheetpiling.

Contractors option on land piers

Land piers V, VI and VII were designed for construction either as open-dredged or pneumatic caissons at the contractor's option. A bearing value on the soil of 3.6 tons was allowed for open-dredging compared to 5 tons for pneumatic due to the more even contact surface expected. The open-dredged caisson was required to be larger and have provision for use of pneumatic methods



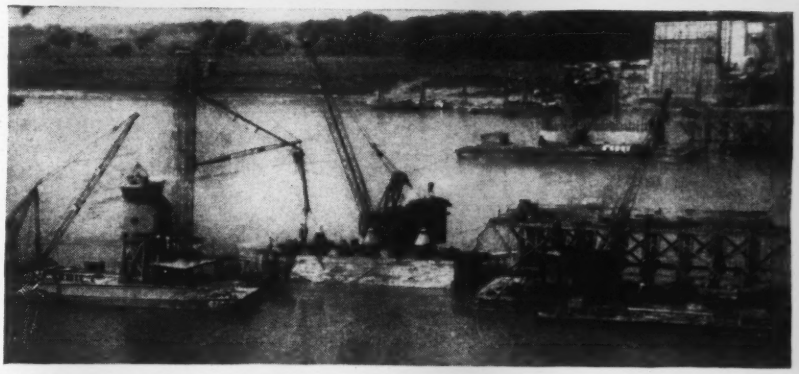


Fig. 5. After being floated into position (top) the caisson for Pier II was sunk by increasing the weight with concrete poured for the pier base. The cofferdam was built higher as the caisson sank.

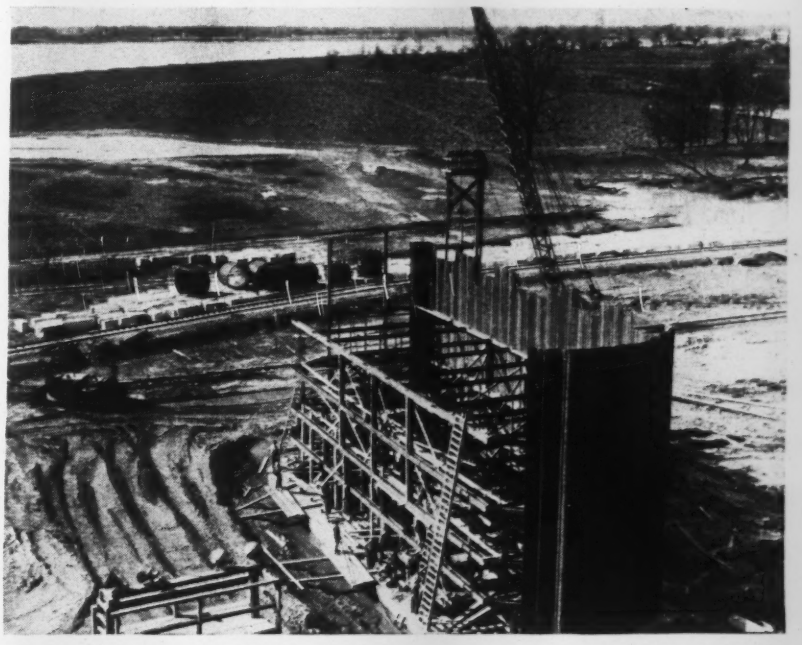


Fig. 6. A single wall of sheetpiles set on top of the caisson sections of all piers except II and III served as a cofferdam to permit masonry work down to the caisson top. Sheetpiles were pulled after pier was complete to above their tops.

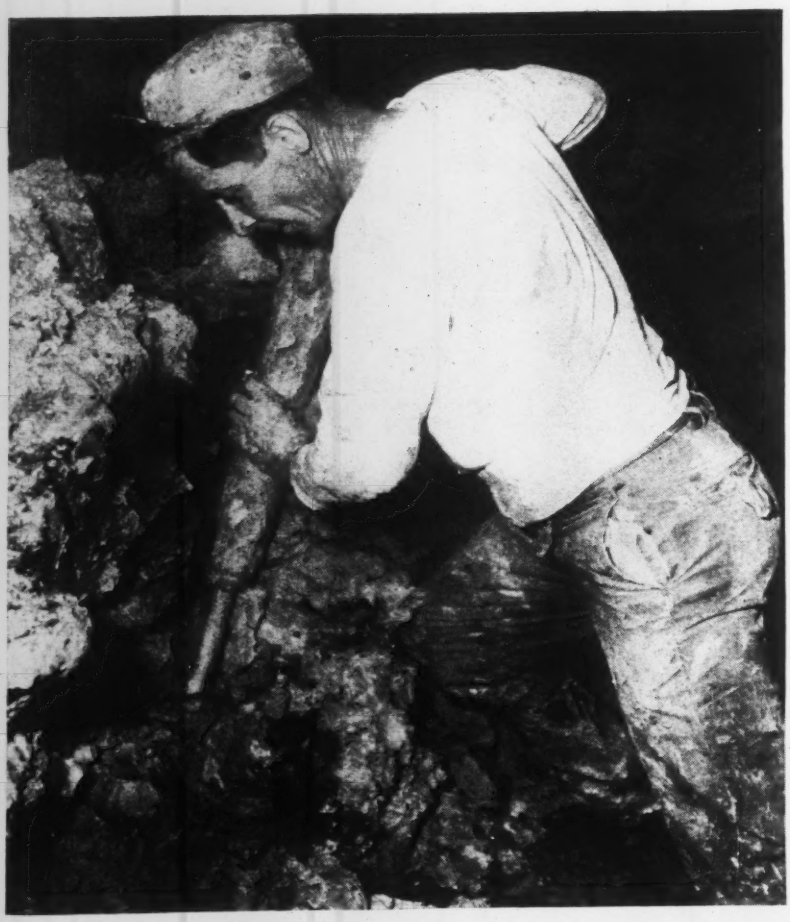


Fig. 7. Typical of the sandy-sticky clay encountered is this material being cut with a clay spade by a sandhog. Air was supplied to pneumatic tools at 105 psi, but they operated at low efficiency in the 43 psi. back pressure of the caisson.

Fig. 8. Piers I and IV, on the sloping banks of the river, were built up inside sand-filled sheetpile cofferdams that gave protection against fluctuating water and provided a level work area.

if it were found necessary, but the contractor chose this method to avoid expensive air work.

The caissons were assembled on the natural ground and built up as described for Piers I and IV with a sheetpile wall attached to the caisson to permit masonry work above the enlarged bottom section of the pier after it was sunk below ground level.

For the open-dredged, tremie-sealed piers, where it was necessary to go through a considerable depth of overburden, jetting wells were provided around the periphery of the caisson. These were 8 in. dia. openings into the work chamber through which the jet pipe could be lowered to break up the sandy clay with a 400 psi. jet. These piers also had exterior air or water jets arranged to lubricate the sides, thus reducing friction and assisting the caisson to sink. Divers checked the bottom to make sure that the area was reasonably smooth and free from loose clay prior to sealing with tremie concrete. All three piers were successfully founded by open dredging.

Concrete for the shore part of the project was supplied by a land plant with two 1-yd. mixers set under batchers attached to a material bin. Pumps under the mixers were able to deliver the concrete wherever needed in the piers but were sometimes supplemented by deliveries in 1 cu.yd. buckets by truck or by rail for placing by crane.

Concrete on the river part of the project was supplied by a floating plant with two 1-yd. mixers delivering to a hoist that carried it up a tower for distribution through a counterweighted swinging chute.

The compressor plant and most other facilities required were located on shore, with pipes on the Frisco Bridge used to carry them out to each of the piers. The "hog house" for the sandhogs, a medical lock and similar facilities were mounted on a barge and moved to successive piers.

On the Merritt-Chapman & Scott Corp. substructure contract William Denny is project manager, J. M. Grieg is in charge of field engineering while R. M. Hand and D. W. Hedrick supervise construction.

O. F. Sorgenfrei is resident engineer for Modjeski & Masters, and is assisted by R. I. Senn.

Precast Floor Slabs for UN Housing

L. F. Booth
George A. Fuller Co., New York, N. Y.

***Contents in Brief**—Concrete slabs cast in concrete forms and handled by lifting with a vacuum-held device are being placed without enclosure and with little regard for weather to speed construction during the winter in New York City of housing for United Nations personnel. Casting is done as weather conditions permit with slabs transferred promptly to point of use.*

CONCRETE FLOOR SLABS for 110 garden-type apartments of two and three stories in New York City are being precast in concrete forms; excess water is drawn from the concrete by vacuum and, next day, the slabs themselves are removed from the forms by vacuum-lifting rigs.

The slabs serve as the finished ceilings as well as the floors of Parkway Village, a housing project being built just south of Flushing for United Nations personnel. The slabs carry a hardwood floor laid in mastic with no subfloor or sleepers. The ceiling side is painted to cover minor form marks and defects so that the slabs are treated and finished with particular care. This is believed to be the first important adaptation of precast and vacuum-handled construction to residential building.

Two- and three-story buildings

The project, Colonial in architecture, will provide 675 apartments varying from three to six rooms, each with a separate garden entrance. Most of the structures are two stories but some are three stories where natural slope of the ground permits entrance at grade to both the first and second-floor. General construction is concrete foundations, cinder-concrete block walls with brick facing, precast floors and tile roofs.

Each floor of a typical building has 24 precast slabs, which vary from about 7x10 ft. to 16x16 ft. An average of only 2½ in. of concrete and 1¼ lb. of steel per square foot is used for floor slabs designed for a load of 40 psf., but successfully withstanding a load test of over 300 psf. The slabs are 1½ in. thick with beams 6 in. deep tapering from 4½ to 2½ in. in width to

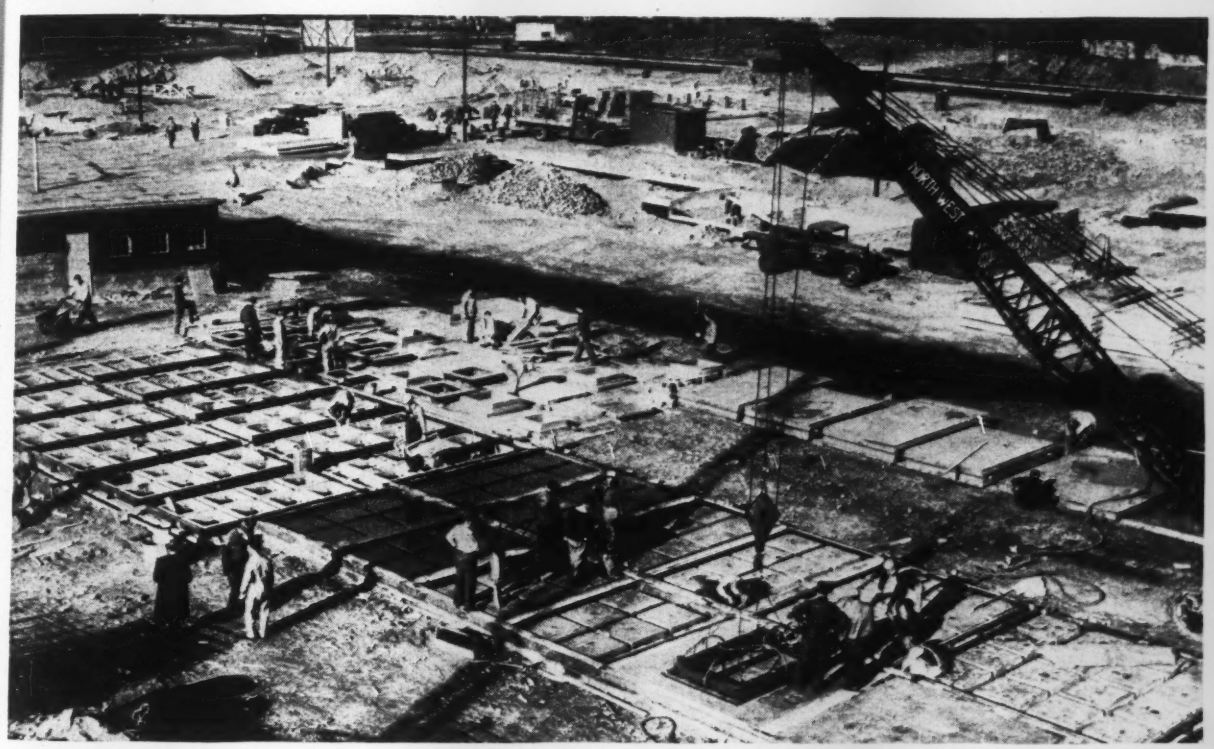


Fig. 1. Small section of slab casting yard at New York City site of precast housing for United Nations personnel. At left rear, cores for the precasting form are being precast. The cores are set accurately 8 in. above the ground and then filled with concrete to make the mold for precasting, seen in center ready for use. In foreground a floor slab cast the previous day is being lifted from the mold, held by a vacuum device. Note variation in size and shape of molds.

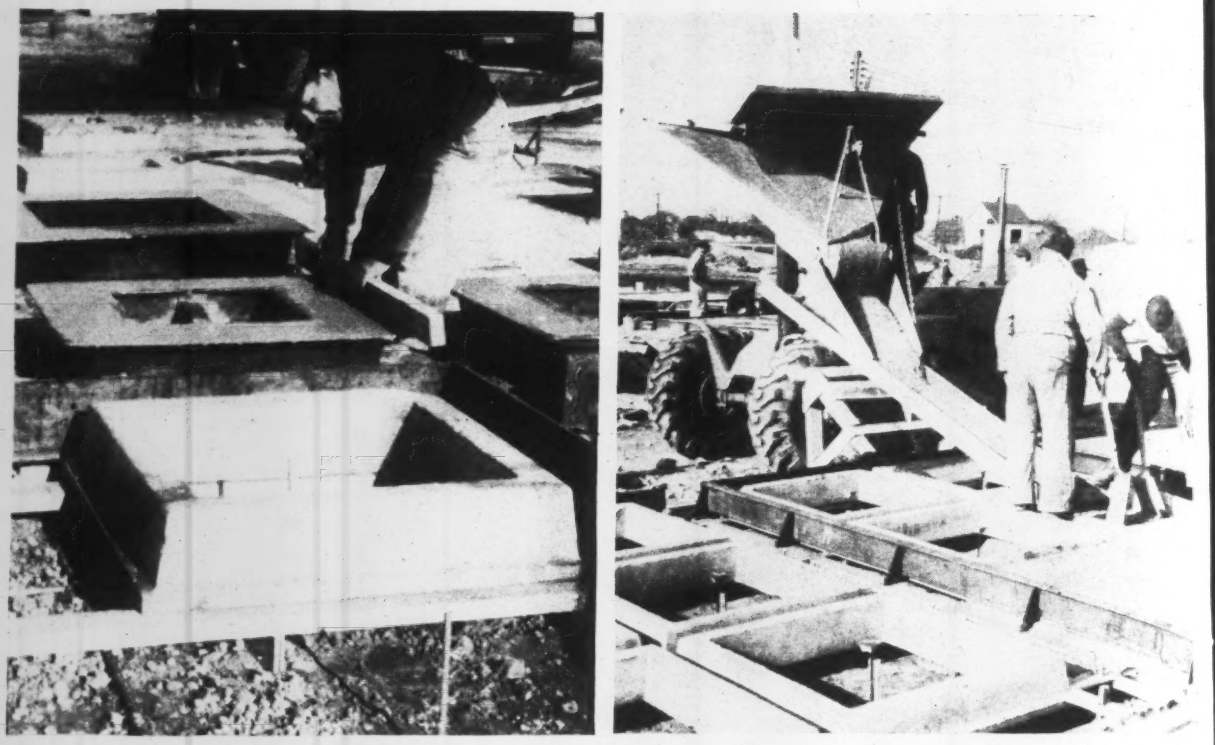


Fig. 2. A core is cast in a metal form (left) and then positioned as the negative of the slab to be cast. Concrete poured in and below the core provides weight and rigidity. Pipes carry high-pressure air used to help break concrete loose from mold. These are located at the center of each core.

provide "draw" for easy removal from the forms. Six bags of high-early-strength cement per cubic yard are used in a mix that attains a strength of about 2,000 psi. in 24 hours and 7,000 psi. in 28 days.

There are 15 basic sizes of slabs, though variations in the locations of sleeves for mechanical trades and for right or left hand location of bearing walls require a larger number of individual types. A total of 6,800 slabs is required for the project. Based on about 70 uses of each typical mold, a total of 115 molds has been constructed, having a total area of 12,000 sq. ft. Forms for some "specials" have fewer uses.

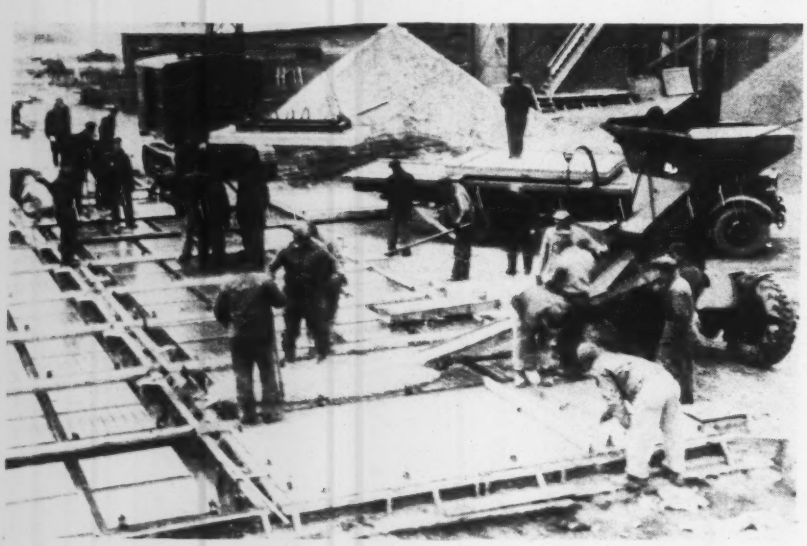


Fig. 3. Crane in background draws a slab from the casting bed and loads it on a truck for delivery to the building site. Forms then are cleaned, preassembled reinforcing is set and concrete for additional slabs is placed, all within an hour.

Theoretically, 115 slabs could be cast each day since setting of the concrete is sufficiently speeded by the use of high early-strength cement with vacuum to remove the excess moisture to permit drawing the slabs from the molds on the day after they are poured. To date, however, the time required for drawing slabs, setting reinforcing, placing sleeves and inserts for mechanical trades and then concreting is such that the complete cycle has been accomplished on only about 70 molds in an 8-hr. day.

Precast molds for precasting

First step in securing accurately precast slabs is fabrication of molds with unusual care to reduce to a minimum the amount of rubbing and cement finishing later required. The molds are made by precasting, in a metal form (Fig. 2, left), a unit about 3x3 or 3x4 ft. that will form each panel. These cores are cast in a metal form to assure smooth sides and then the core is turned upside down and

accurately positioned in a form made to the outline of the ceiling side of the precast slabs (Fig. 2, right).

Cores are blocked up high so that when their centers are concreted, a heavy integral concrete base will be provided. This weight is necessary to give rigidity and to prevent the entire mold from lifting when the precast slabs are drawn. Small pipes and a header are cast in place with an outlet at the center of each of the small bays and used to admit air under pressure to assist in loosening the slab when it is being lifted from the mold.

Reinforcing is preassembled in welded cages and set into place as a unit. Concrete is transported from a central mixer by a self-powered, concrete-hopper carrying rig that is arranged so that the hopper can be raised to a considerable height to permit chuting the concrete to position from the side of the casting bay. Immediately after placing, the concrete is screeded carefully to the top of the form and then vacuum mats are applied to pull the excess water from the concrete. Such processing permits finishing to be done immediately, a definite advantage in cold weather concreting, since it speeds setting.

The next day the cast slabs are withdrawn from the molds by means of a vacuum lifting mat. A vacuum of from 15 to 25 in. of mercury is used, producing a lifting force of about 10 psi. The initial separation between slabs and molds is aided by a "shot" of compressed air applied in the center of each panel through the pipe shown in Fig. 2.

The slabs are stacked or hauled directly to the location where they will be used for installation as wall construction permits. Vacuum lifting has been used to set some of the concrete slabs into place in the building but the system has not yet been made fool-proof. After initial withdrawal from the form, the slabs generally are handled with strap slings or with wire slings and bolts through openings otherwise required in the slab. Once in place, the slabs are bolted down to columns and points are grouted in preparation for placing of the wood floor.

Parkway Village is being erected for the Savings Bank Trust Company, a holding organization representing a number of participating savings banks for rental to United Nations personnel. Leonard Schultze Associates of New York are the architects. Precasting features were developed by E. H. Praeger of Madigan-Hyland, the consulting engineers. General contractor is the George A. Fuller Co. of New York.

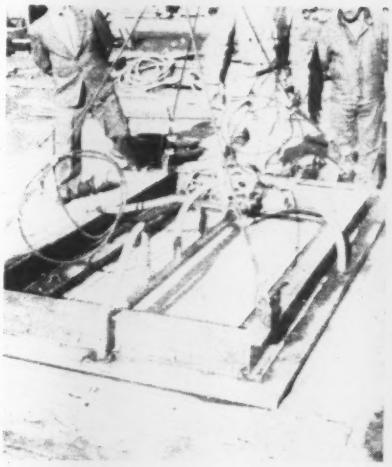


Fig. 5. Vacuum is applied to areas on the lifting frame to give a lifting force of 10 psi. for a slab weighing 31 psf.

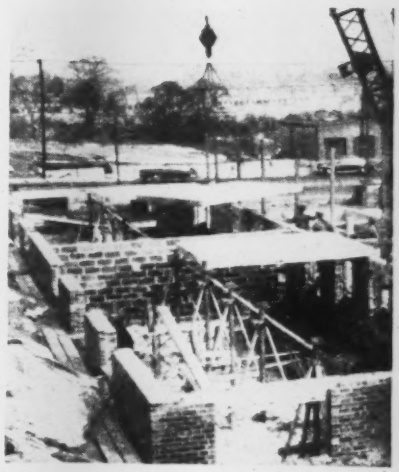


Fig. 6. Slab for first floor being set in three-story building to rest on walls or on interior columns.

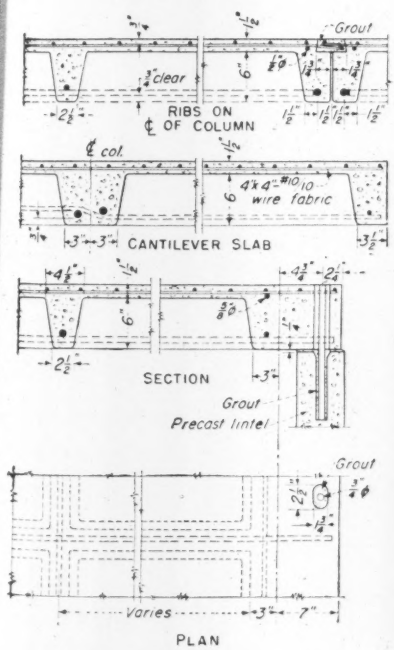


Fig. 4. Details of slabs precast for floors of Parkway Village houses.

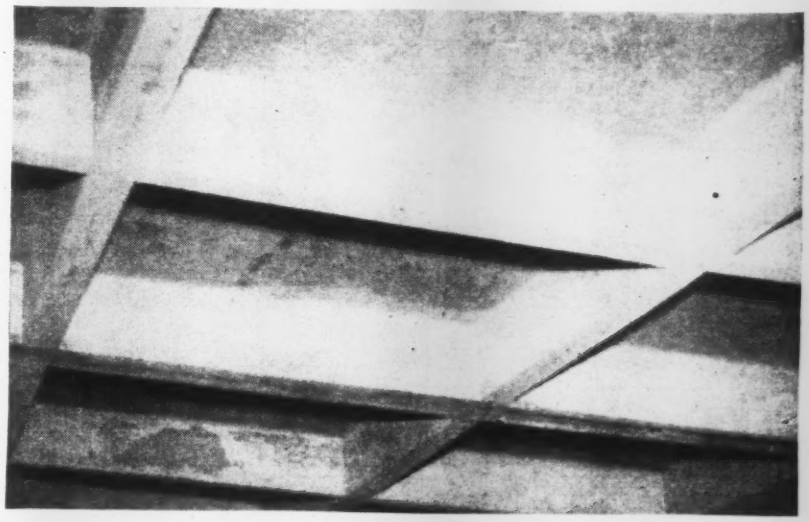


Fig. 6. Under side of precast slab, which forms the finished ceiling of an apartment. Many slabs are ready for painting just as they come from the molds.

Gravimetric Analysis of Sand

L. J. Ehly
Chemical Engineer, City of Vancouver, Vancouver, B. C.

The article on "Rapid Field Test of Bituminous Mixes" by M. A. VerBrugge published in *ENR* May 30, 1946, vol. p. 843, was noted with interest since I have used a similar method in determining the moisture content of stabilized gravel base. The apparatus used by me differs only in the size and shape of the Chapman type flask.

The method outlined by Mr. VerBrugge might well be defined as a volumetric analysis of mechanical mixtures, the constituents of which differ appreciably in specific gravity. The test is possible only when the constituents differ in densities. The following is the gravimetric version of the same test which might be of interest to your readers. It was devised as a means of determining the moisture content in sand used in producing plant-mix portland-cement concrete. The time required to carry out a complete determination is about three minutes with an accuracy of approximately 0.3 percent. It is thus possible to check the water content in each load leaving the mixer. It has been used with satisfaction at the concrete plant of the city of Vancouver.

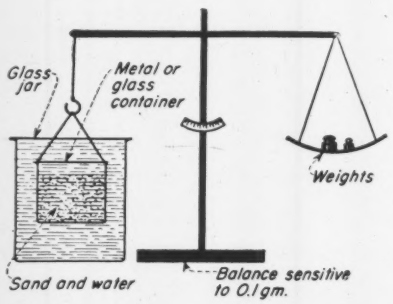


Fig. 1. Arrangement used in weighing samples once in air and once in water.

In brief, the method consists of weighing a sample in air and again in a liquid and calculating the percent of each constituent from the weight, volume, and density relationships. The test as actually carried out at the concrete plant is as follows: One thousand grams of sand are weighed out accurately in a wide-mouthed container. The sand is then covered with water and stirred vigorously to expel all the air. The sample is then weighed in water. To the weight in water is added the buoyant force on the empty sample container which has been previously determined and the moisture content is read from an accompanying chart.

The chart is made up on the following basis:

Weight in water of 1,000 gm. dry sand =

$$1{,}000 - \frac{1{,}000}{\text{specific gravity of sand}}$$

Weight in water of 1,000 gm. moist sand (Made up to contain 10 percent moisture on wet basis *i.e.*, 900 gm. sand and 100 gm. water) =

$$\left(900 - \frac{900}{\text{sp. gr. sand}}\right) + \left(100 - \frac{100}{\text{sp. gr. water} = 1}\right)$$

These formulas define the curve for a particular specific gravity of sand —practical moisture range, 0 — 10 percent. Parallel curves were plotted for sand with specific gravities of 2.64, 2.66, 2.68, and 2.70 covering the conditions encountered.

With specific gravity determined, subsequent analyses consist simply of weighing a sample once in air and once in water—what quicker and more accurate method of analysis is there than by simple weighing?

Regardless of the method used, the specific gravities of sand or gravel in successive samples is a variable factor. Fortunately the variation is generally insignificant and it can be closely approximated. Even in the volumetric method described by Mr. VerBrugge, the specific gravities of the gravel in the oiled and unoiled samples may differ though they were taken from the same location.

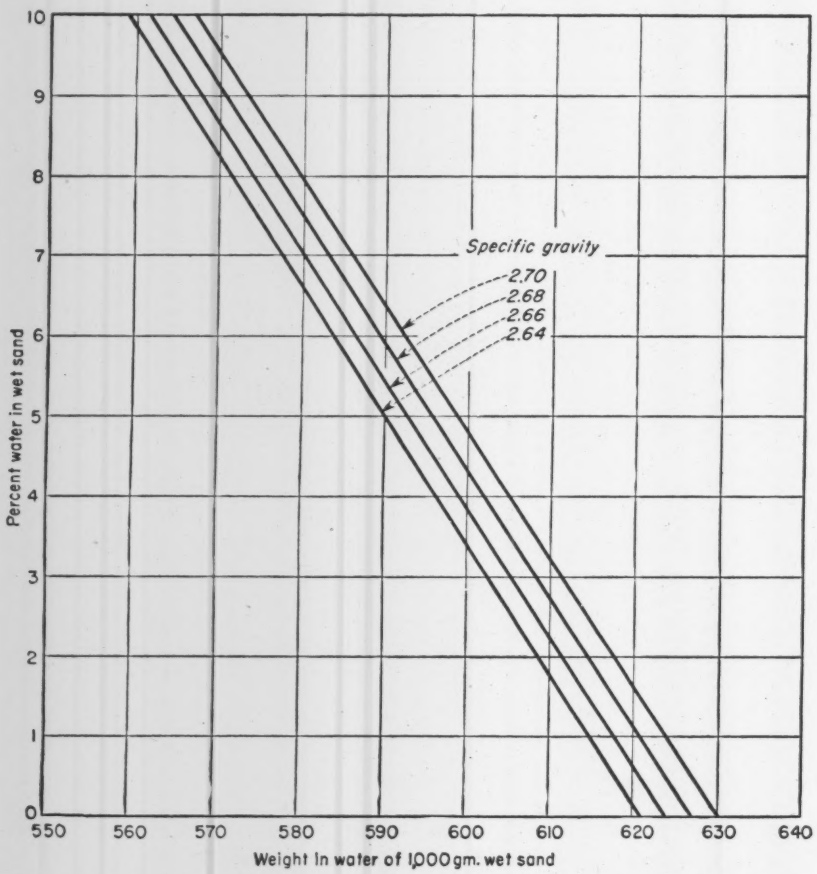


Fig. 2. Chart used to determine the moisture content of sands after the specific gravities had been measured.

High-Speed Form Vibrators Improve Concrete Pipe Manufacture

***Contents in Brief**—Specifications for concrete for pipe ranging in size up to 96-in. diameter to be used on the San Diego Aqueduct required that the concrete have less than a 4-in. slump. Contractors accordingly revised their pipe-making methods and attached high-speed vibrators to the steel forms and got good results with slumps which averaged some 2½ in.*

SPECIFICATIONS calling for a maximum slump of 4 in. for concrete used in large reinforced concrete pipe for the San Diego Aqueduct made it necessary that normal manufacturing procedures be revised. The use of high-speed vibration of the steel pipe forms made it possible for concrete with an average slump of some 2½ in. and with 1¼-in. maximum aggregate to be quickly placed in the forms where the minimum opening was only 1½ in.

Some 67 miles of the 72-mi. aqueduct is made up of large reinforced concrete pipe. Other sections of the conduit consist of steel pipe, tunnels, and a reservoir. The aqueduct is being built to bring Colorado River water to the San Diego area via the Colorado River Aqueduct of the Metropolitan Water District of Southern California and was described in *ENR* March 6, 1947, vol. p. 362.

Four concrete pipe sizes are employed on this project, namely: 48, 54, 72 and 96-in. diameter. The 96-in. pipe is made in 12-ft. lengths and all the rest in 16 ft. lengths. Each length is provided with bell and spigot steel joint ring assemblies, which are sealed with synthetic rubber gaskets when laid.

Pipe reinforcing is divided into two general classes, namely: cylinder and non-cylinder. The non-cylinder type is used for all pipe to be subjected to a static head of 125 ft. or less and this type contains two courses—one inside the other—of wire spirally wound in the form of cylinders. This wire varies in size from $\frac{7}{16}$ in. to $\frac{7}{8}$ in. and is welded to ⅝-in. longitudinal bars. The inside longitudinal bars are in turn welded to the joint rings.

The cylinder type includes the use of a steel cylinder and this is used where the static head is between 125 and 500 ft. (steel pipe is used on the San Diego Aqueduct where the head exceeds 500 ft.). The steel cylinder varies in thickness from 14 gage to 7 gage and it replaces the inner course of reinforcing. Where extra heavy reinforcing is required, the steel cylinder is wrapped with spirally wound wire.

Each length of pipe is designed for a particular location on the line. The reinforcing varies according to the amount of backfill expected over the pipe and the amount of head to which the pipe will be subjected. The size of the pipe varies from 18 in. to 72 in. according to the slope on which the pipe is to placed.

Fig. 1. Concrete was poured into the pipe forms from a bucket carried by a locomotive crane. Note the vibrators attached at one-third the form height.

The 96-in. pipe was used to connect the equalizing reservoir of the aqueduct with the Colorado River Aqueduct. Special sulfate-resisting cement was used for pipe to be laid where the soil and ground water were thought to contain sulfates in quantities sufficient to be injurious to the concrete. Thickness of the pipe varies as follows: 72-in. pipe—7½ in. thick, 54-in. pipe—6½ in. thick, and 48-in. pipe—5¾ in. thick. Concrete was made with a water-cement ratio varying from 0.50 to 0.57 and with 1.47 to 1.70 barrels of cement per cubic yard. Compressive strength at 28 days was between 4,500 to 6,000 psi.

Improved vibration method

In the past in manufacturing large concrete pipe it has been common practice to use some form of internal vibration to assure even distribution of the concrete. For example, in some cases a ¾-in. square rod of sufficient length was attached to an air-gun and inserted by hand at a number of places on the inside of the forms.

However, such methods did not prove practicable in making pipe for this project as the specifications provided that concrete with a slump of 4 in. or less be used. Internal vibration was not sufficient to force such a stiff mix into the small openings which, between the forms and the reinforcing, was only 1½ in. The size of the pipe and amount of reinforcing employed precluded spinning the lengths.

After considerable experimentation, a method was developed whereby high speed pneumatic vibrator motors were attached to the steel forms by means of a bracket. A satisfactory combination was the attachment of two vi-

brators, one on each side, at about one-third the form height. These motors develop speeds of 8,500 to 9,000 rpm. and were taken from standard high speed vibrators with the head, flexible drive-shafts and couplings removed. Two motors so attached tend to supplement each other and increase the amplitude of vibration.

Best at 7,000 rpm.

Navy inspectors, satisfied with the results obtained, soon decided to require some 7,000 vibrations per minute. To measure the speed and amplitude of the vibrations a vibrometer was used by the inspectors. This type of meter is normally used in industrial plants for checking the vibrations induced by various types of machinery.

In making the pipe the first step is to wind the cages of reinforcing. This is done by feeding the wire from spools on to a rotating framework with jigs to govern the wire spacing. The longitudinal bars are then welded to the cage and the bell and spigot joint ring assemblies are attachel to each end. The bell ends of these cages are placed over a base ring set in concrete. The seal between the bell at the bottom end and the base ring has to be good or the high speed vibration will cause concrete to leak out around this joint.

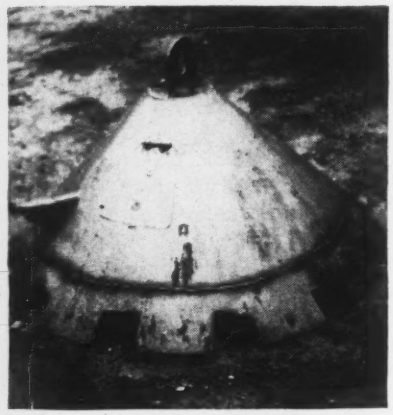


Fig. 2. Cone-shaped baffles such as this were mounted at the top of the forms to spread the concrete evenly into the circular forms in vertical position.

Steel forms are placed around the reinforcing, the inside form has a collapsible section and the outside form is bolted. The shape of the forms is maintained during pouring operations by the base ring at the bottom and by a form spreader at the top which is held in place by lugs that are moved into place by levers. To divert the concrete into the proper space, a cone-shaped baffle is set on top of the spreaders. Notches were cut in the cone at the base to enable it to fit around the spreader lug levers.

Forms are set up in series of three for 72-in. pipe and four for 54- and 48-in. pipe. Concrete made in a central mixing plant is delivered by locomotive cranes carrying standard concrete buckets of 4-cu.yd. capacity. A workman rides each bucket and opens and closes the gates by means of an air ram with an air connection to the locomotive crane.

In pouring concrete for a series of three or four pipes, a small amount of grout is first placed in each form to coat the reinforcing with a mortar wash. Concrete from each of the first few buckets is distributed among each of the series, as it is not deemed advisable to place concrete faster than the vibrators can level the mass and remove the air pockets.

Plywood housings for steam curing

After each series of pipe is cast, housings made of waterproof plywood are placed over the pipe and the concrete is cured with thoroughly saturated steam for a period of 72 hours at a temperature of some 140 deg. F. After the concrete has taken its initial set, the housings are removed and the forms are stripped. The plywood housings are then replaced for the balance of the steam cure. After steam curing, the pipes are placed on skids in a storage yard and hauled to the job on suitable trucks a few days in advance of the laying crews.

When work first started on this pipe manufacture, it took two 8-hr. shifts to make 25 lengths. With the improved methods herein described and with increased efficiency of the crew, as many as 52 of the 16-ft. lengths were made in one 8-hour shift.

Concrete pipe for the San Diego Aqueduct is supplied by two fabricators, each using essentially the same manufacturing procedure. These two are the American Pipe & Construction Co., South Gate, Calif., which makes the pipe at the El Cajon, Calif., plant and the United Concrete Pipe Corp., Baldwin Park, Calif., which makes the pipe at its main plant at Baldwin Park. General supervision of the project is under direction of officers of the Civil Engineer Corps of the United States Navy. Representatives of the Bureau of Reclamation act in a consulting capacity to the Navy.

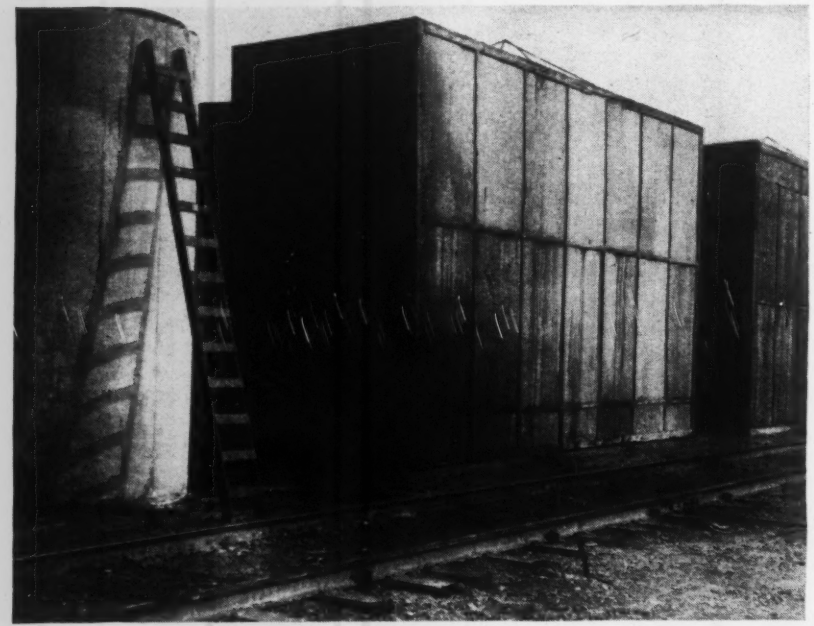


Fig. 3. Steam curing was effected by placing a waterproof-plywood housing over each series of pipes after the forms were stripped and then subjecting the pipes to steam at 140 deg. F. for a period of 72 hours.

Holes for Blasting Purposes Sunk in Rock by Fusion Piercing

In recent experiments in the Mesabi mining region of Minnesota that may be of interest to the construction industry, six-inch vertical blast holes have been made by fusion piercing. Rates as high as 17 ft. per hour were attained in hard and very abrasive taconite iron ore.

Churn drilling on the same ore some years ago averaged only 1 ft. per hour compared to the 10 ft. per hour average for 30-ft. deep holes in the fusion piercing tests. Some experimental work has also been done and more is planned on smaller holes, slope and horizontal drilling and on other classes of rocks.

In fusion piercing, a flame with a temperature of 4,000 deg. F., produced by burning oxygen and a flux-bearing fuel in a special blowpipe, is directed against the surface of the rock. As the rock spalls or melts it is subjected to a water spray quench that further breaks it up, at the same time forming steam that helps the gases force the broken material out of the hole. The water also serves to keep the burner tip cool.

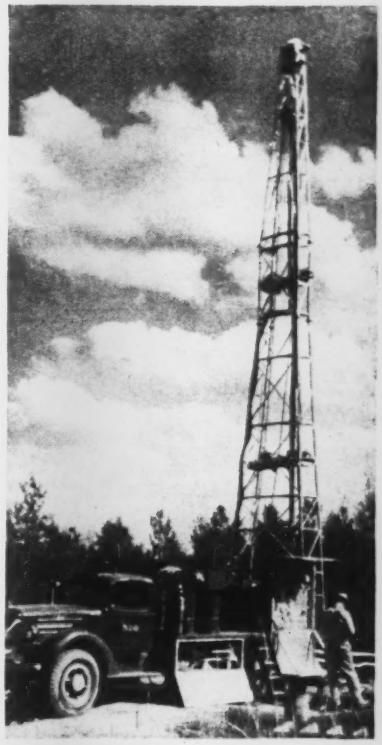
Equipment for commercial use is in the development stage. For the field tests, a truck was equipped with a portable all-steel drill rig. Replacing the "Kelly" of the drill rig, a 30-ft. long 4½-in. O.D. blowpipe carries the water, oxygen and flux-fuel through separate channels from the head of the blowpipe to the multiple-port burner at the lower end.

Near the bottom of the rotating blowpipe, just above the burner tip and water ports, hard-faced blades break loose any slag that might not be forced out. Actually, the work done by this device is largely to grind the particles and to size the holes.

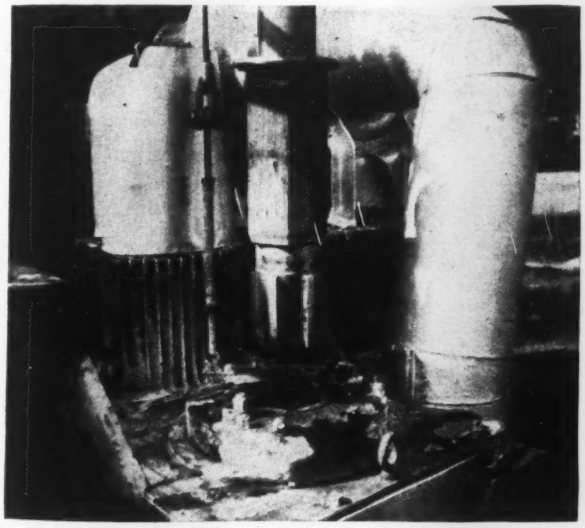
An exhaust fan draws off the steam and gas discharging it away from the rig. Rock particles are deposited around the collar of the hole and are removed by hand.

The experimental unit is entirely self-contained with a 15 kw. power plant mounted on the truck platform to provide power for nine electric motors that operate the turntables, auxiliary devices and the winch. The pictures show a rather complicated rig, but this includes recording instruments and other apparatus for collecting data. Commercial machines will be simplified so that they can be handled by a single operator and a part-time helper.

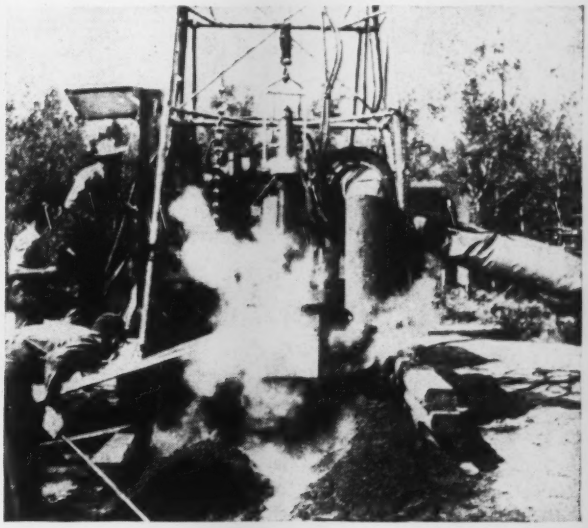
Fusion piercing is a patented process, and was developed by The Linde Air Products Co., a unit of Union Carbide and Carbon Corp., which is carrying out the experimental piercing described on the property of the Reserve Mining Co. at Babbitt, Minn.



Portable drill frame supports 30-ft. blowpipe that carries water, oxygen and flux-fuel to pierce rock by spalling or melting.



Blowpipe is rotated by a turntable through the square-edge sliding collar. Hard-faced blades just above burner size the hole. Pipe at right carries fumes and steam to suction side of blower.



In operations one man handles the equipment from a control panel, and another removes slag or spalled material from the collar of the hole from time to time. A fan blows exhaust gases and steam away from the rig.

Comment and Discussions

Readers' opinions on matters that concern engineers and contractors

FPHA Without Building Fund

Sir: Permit me to call to your attention a mis-statement regarding the low-rent public housing program that appeared in your news report on the U. S. construction budget for 1948 (ENR Jan. 16, vol. p. 77).

In your survey you report that construction work will be done out of a fund of $8,300,000 requested by the National Housing Agency for the low-rent housing program. Actually, however, this money will not be used for any construction activity. This fund comprises the total annual subsidy payments to be provided by the Federal Public Housing Authority, the NHA constituent which administers the public low-rent housing program, to localities with active low-rent projects. Such subsidies are utilized to help keep rents within the means of low-income families living in the projects.

Construction of low-rent housing projects is accomplished by local housing authorities with the FPHA's assistance in the financing of development costs. All of the funds for development loans authorized for this program by the U. S. Housing Act have been committed. Except for some few projects already approved on which construction has been deferred, all new construction of federally-aided low-rent housing is contingent upon Congressional approval for an extension of the program.

CHARLES M. SMITH,
Director, Information Division, FPHA

River Valley Flood Protection

Sir: The editorial (*ENR* Nov. 14, 1946 vol. p. 637) praising the work and pioneer efforts of the Miami Conservancy District might also be read, in some parts, as critical of the national flood-control policy of controlling whole river systems as contrasted with works for mere local protection. If that be so, I could not agree that that criticism is justified.

It was my good fortune to have been identified with the Ohio Constitutional Convention in 1912 that made the Miami Conservancy District possible. The work done by the district was indeed remarkable, but it is incomplete, since the reservoirs are not multiple-purpose basins but merely hold back enough of the flood waters temporarily so that destructive flood levels in the Miami Valley are eliminated. What happens to downstream communities from the excess flood waters that continue to flow through the hole in the bottom of the Miami Valley dams at the wrong time was not taken into account.

Gates should now be installed on these dams so that some of the flood water will be held back and conserved. Most important, the operation of the Miami Valley works should be coordinated with the other protection and conservation facilities now in the making in the Mississippi and its tributaries. This is the essence of our enlightened national flood-control policy and is the opposite of a selfish desire of self protection and to get rid of our excess flood waters only to send them down onto the other fellow, together with the best of our top soils, and then tell him to take care of our surplus waters that we think we do not need.

This idea of the conservation of our water resources is growing, and some day, in the "fullness of time" the engineering fraternity will realize that, as a nation, this is a national problem and must be solved in a national way and not in just local selfish protection of our small communities, without any care as to what may happen to the other fellow downstream below us.

I thank God that the Miami Valley, with the Morgan Plan, was willing to pay the price of self protection, for out of that expensive insurance policy has evolved the more comprehensive coordinated authorized federal flood-control plan of our national Congress for the Army Engineers.

As you can plainly see from these observations, the only logical thing for the Miami Conservancy District to do is to become a part of the comprehensive federal plan and to coordinate their operations with the Ohio River authorized federal plan, by modernizing its reservoirs so that they can be controlled with gates, so as to keep the Miami floods from syncronizing with the crests of the Ohio River floods.

DAVID C. WARNER
Water Conservation Consultant
Ohio Department of Public Works

Editor's Note—Mr. Warner read more into the editorial than was actually said. There was no criticism stated or implied of the policy of treating riversheds as integrated units for flood protection and water conservation. That is the only effective, fair and efficient way to meet the problem. The critical comment in the editorial was directed against those localities who would avoid all responsibility and any payment for benefits, preferring that the entire cost be borne by the federal government. The Miami Conservancy District was cited as our finest example of the discharge of local responsibility. Times and circumstances have now changed, and local communities have a right to both federal and state aid in flood protection. But they still have responsibilities, both moral and monetary, to discharge under the flood-control policy of today.

Origin of "Sand-Island" Method

Sir: The opening sentence of Mr. Blaine's most interesting article on "Practical Lessons in Caisson Sinking from the Baton Rouge Bridge" (*ENR* Feb. 6, vol. p. 213) inferentially supports the prevalent view that the "sand-island" method of bridge pier construction was a North American development of the Thirties. It might be well, therefore, to get into the record the fact that this method was developed in Australia where it was successfully used for the founding of the piers of the Grey Street Bridge in Brisbane in 1927 by Messrs. M. R. Hornibrook Ltd. Details of this little-known bridge job were published in *Civil Engineering* (London) vol. 26, p. 55, 1931.

ROBERT F. LEGGET
Associate Professor, Civil Engineering
Department, University of Toronto

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Modified Ditcher Reduces Canal Maintenance Costs

Canal maintenance crews of the Owyhee project of the Bureau of Reclamation and on the Black Canyon Division of the Boise project have been able to reduce the cost of cleaning small canals by use of the ditcher shown in the accompanying photographs.

This ditcher is also being used to good advantage on construction of new canals on the Lugert-Altus project by the James & Phelps Construction Co., Oklahoma City, Okla.

The first ditchers of the general type illustrated were employed several years ago, but the model illustrated is considered to offer major advantages over the older units. The rig is mounted on pneumatic-tired wheels, which reduces side slipping when the unit is in operation and makes the unit mobile for transfer from one job to another. Also the depth of the cutting is controlled hydraulically. Moreover, the rig is sufficiently rugged for use with the larger crawler tractors.

Fig. 1. Cleaning of existing irrigation canals is expedited by means of a ditcher hydraulically controlled and mounted on pneumatic tires. Normally the ditcher is pulled by a single large tractor, but in this case two smaller tractors were used.

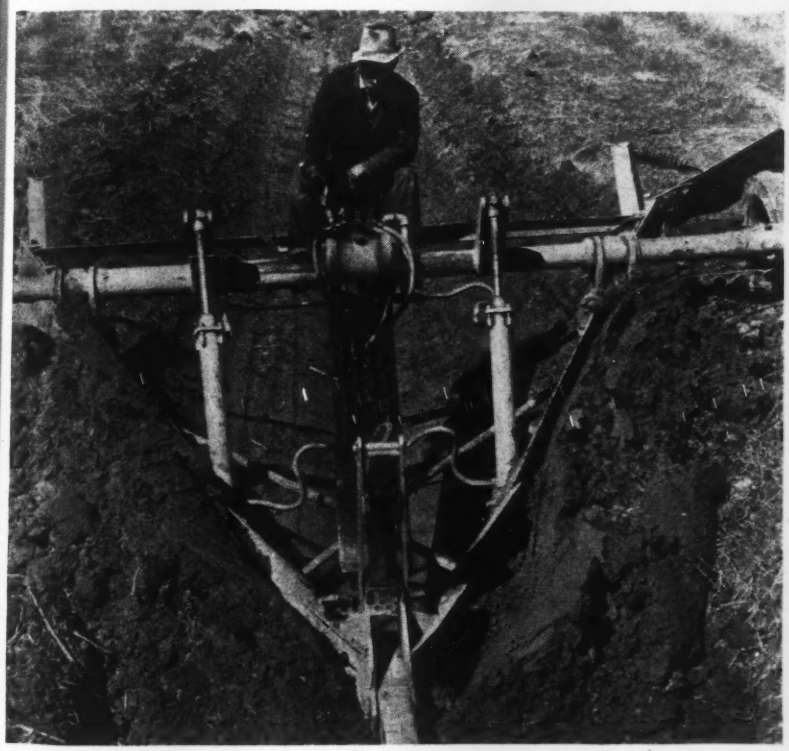


Fig. 2. The depth of cutting is controlled by three hydraulic pistons, one controlling the depth of the point and two for positioning the side blades.

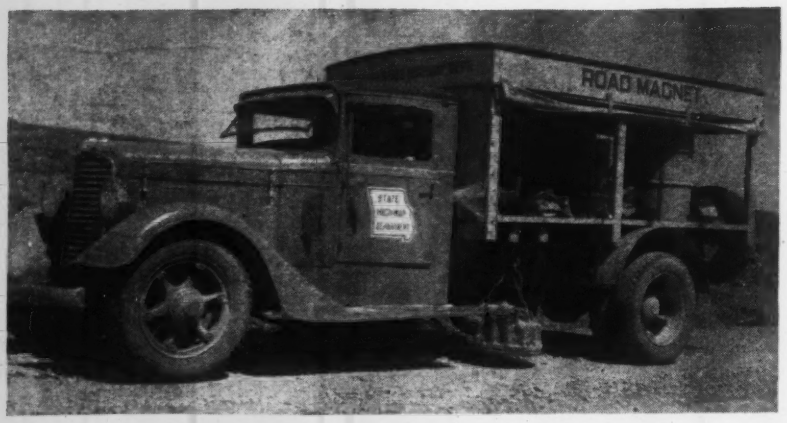
The ditcher can be used for cutting a ditch 5 ft. wide at the bottom, 15 to 16 ft. wide at the top and 3 to 3½ ft. deep, with a large variety in the slope of the sidewalls. The unit is also designed to level the bank at either side for a distance of 1½ ft.

Chattin Ditcher Co., Boise, Idaho, is the manufacturer of the excavation machine shown.

Traveling Magnet Clears Missouri Roads

An improvised road magnet keeps Missouri's state highways relatively free from tire-damaging metallic objects.

It operates at about 12 mph. exerting a magnetic pull of 60 psi. over an 8-ft. width of roadway. It has three 24-in. dia. electric magnets, two hung directly in front of the dual rear wheels and one from the center of the rear end of the truck. Each magnet weighs 960 lb. and can be raised or lowered as necessary to pick up all metallic objects. Due to the weight of the magnets, it was neces-



Sharp metallic objects are cleared from an 8-ft. width of highway with each passage of Missouri's traveling road magnet.

sary to install additional "helper" springs on the chassis of the two-ton truck used.

The electric magnets are powered by a 3½-kw. generator, driven by a 12-hp., 4-cylinder motor. The generator furnishes from 18 to 20-amp. of direct current at 110 to 120v. The truck also is equipped with a panel control board on which is mounted an ammeter, voltmeter and rheostat for generator operation and with a switch to de-energize the magnet to unload.

A number of safety features are built into the unit. The load cannot be raised or lowered unless the motor is in operation and the winch lever engaged so that a sudden drop of the load is not possible, regardless of weight. To eliminate danger of whip of the cable in the event of a break the winch speed has been slowed. A chain at the top holds the A-frame in a fixed position while the lower chain is a safety device to prevent pulling the movable boom over the rig.

Derrick Made from Weapons Carrier

A ¾ ton 4x4 army weapons carrier was converted into a mobile derrick by the District Office of the Corps of Engineers at Wilmington, N. C., for use in moving moderately heavy articles around the repair yard. The winch unit has a capacity of approximately 5,000 pounds.

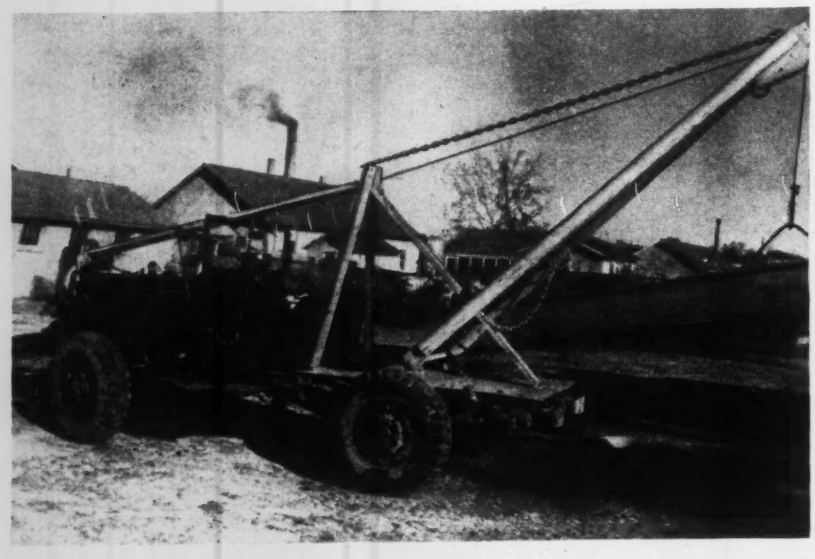
Simple Rack Simplifies Storage of Brooms

At the Laurel district shops of the Maryland State Road Commission the maintenance crews are finding the rack illustrated below of great value in storing extra brooms for mechanical sweepers.

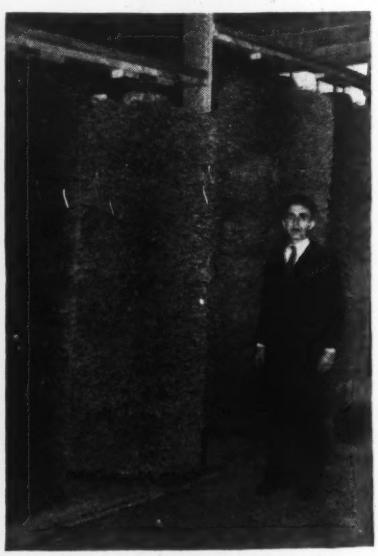
It has proven desirable to have spare brooms on hand at all times and to keep the new units off of the floor to both prevent their decay and to save room. Formerly the spares were suspended overhead out of the way by cables attached to the steel roof framing of the equipment shops. But one day a truck with a high load in moving out of the building caught and broke one of the supporting cables, seriously injuring one of the workmen.

To provide much safer storage the rack shown was built at little cost. It is located between two stalls and takes up limited space. Experience has shown that the brooms can be set in place or taken down quickly, saving much time over the old procedure. The present method is also much safer.

The rack was built under the direction of Walter Sayers, maintenance engineer for the Laurel district.



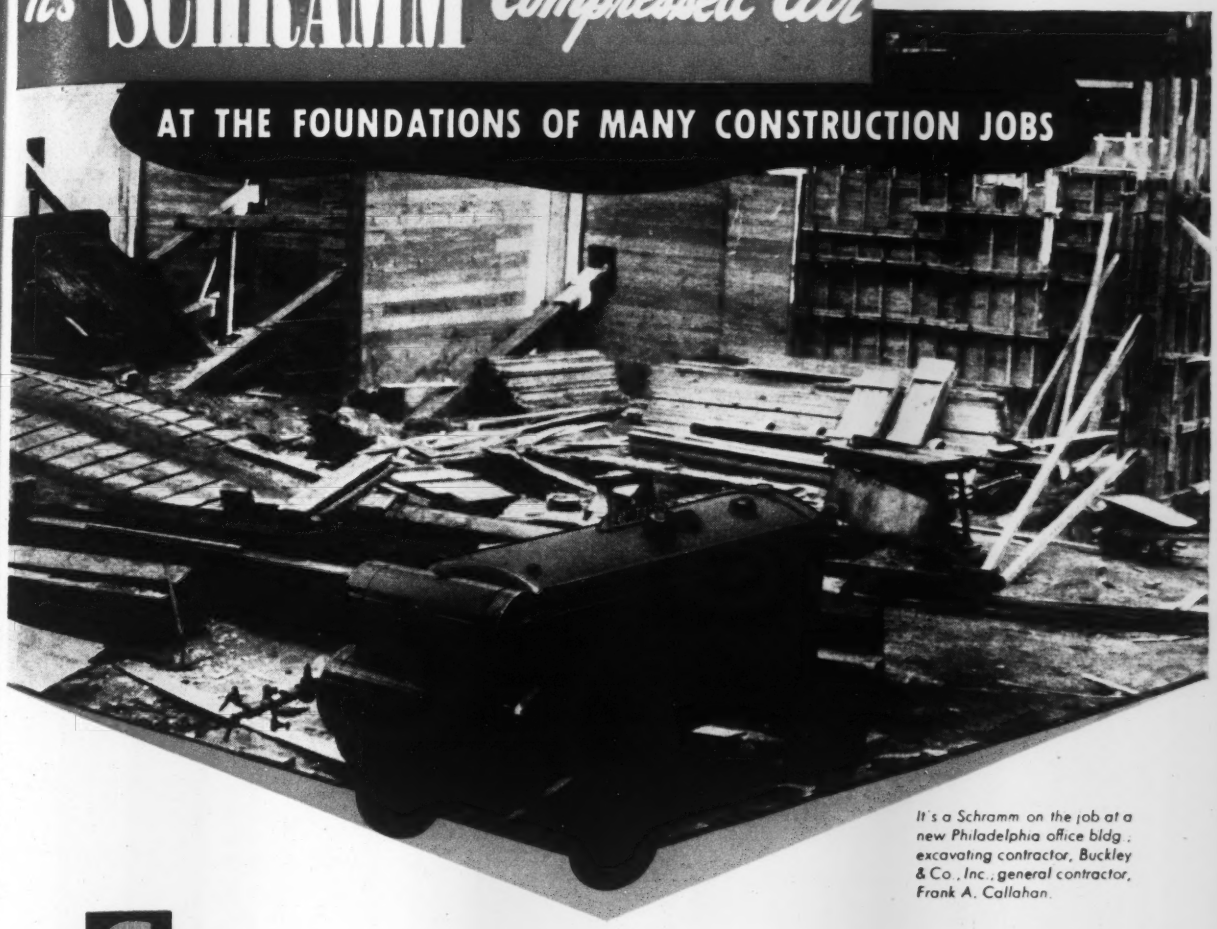
A cable from a power-winch on the front of the truck passes over the frame and through two rollers at the top of the boom support to provide a fairlead for the cable with the boom in any position. Capacity of the winch and rig is 5,000 lb.



To store spare brooms for mechanical sweepers highway maintenance crews at Laurel, Md., use this method.

It's SCHRAMM Compressed Air

AT THE FOUNDATIONS OF MANY CONSTRUCTION JOBS



It's a Schramm on the job at a new Philadelphia office bldg.; excavating contractor, Buckley & Co., Inc.; general contractor, Frank A. Callahan.

Schramm Air Compressors play a vital role in construction jobs from the foundation up. Excavating, drilling, driving sheeting and a hundred and one other uses of a Schramm . . . make it the "good right arm" of construction engineers. Reliability and mobility are what these engineers demand and that's what they get in a Schramm Compressor.

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Schramm Compressors are available in all types of assemblies and mountings. Four other features make it ideal for all-round, all-year use in the construction fields: Main bearings for every cylinder, 2. Mechanical intake valve, 3. Multi-cylinders and lighter parts, and, 4. Forced feed lubrication.

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SCHRAMM, INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

UNIT PRICES BID BY CONTRACTORS

Concrete Pipe Water Supply Line and Weir Houses, Provo, Utah

OWNER: City of Provo, Utah; Thomas H. Latimer, City Engineer.

PROJECT: Construction of concrete pipe water supply line and two weir houses at the mouth of Provo Canyon, Provo, Utah. Work involves the laying of 17,250 lin. ft. of 48″ concrete pipe and 1,160 lin. ft. of 20″ and 24″ cast iron "blow off" pipe.

CONDITIONS: City of Provo will furnish f.o.b. Provo all gates, valves, recording instruments, cast iron pipe, and joint material for cast iron pipe. All materials must be hauled to job and installed by contractor. Costs may prove high due to necessity of right of way through pear, peach, and apple orchards. Contract time is 180 calendar days. Skilled labor wage rates range from $1.625 to $1.75; semi-skilled labor, from $1.15 to $1.25; and common labor, from $.875 to $1.00.

BIDS: Six bids were received November 26, 1946, ranging from the contract low of $301,842.08 to $452,123.30.

LIST OF BIDDERS:

1. Utah-Idaho Concrete Pipe Co., Salt Lake City, Utah (contract) $301,842.08
2. Wheelright Construction Co., Ogden, Utah 310,089.15
3. Enoch Smith Sons Co., Salt Lake City, Utah ... 372,161.50
4. Neils Fugal, Pleasant Grove, Utah 377,635.85
5. Utah Construction Co., Salt Lake City, Utah 430,423.05
6. Stolte, Inc., Oakland 3, Calif. 452,123.30

	Item	Quantity	Unit Prices (1)	(2)	(3)
1	Excavation for 48″ pipe trenches	38,425 cy	$0.68	$0.56	$0.60
2	Excavation for 20″ and 24″ pipe trenches	795 cy	.345	.38	.60
3	Excavation for structures (weir house not included)	191 cy	2.50	2.00	2.00
4	Compacting backfill of 48″ line	1,804 cy	2.44	1.75	2.00
5	Compacting backfill of 20″ and 24″ line	16 cy	2.44	2.00	2.00
6	Backfill 48″ line	25,491 cy	.32	.11	.50
7	Backfill for 20″ and 24″ line	684 cy	.32	.11	.50
8	Furnishing and laying 48″ concrete pipe	17,250 lf.	13.91	14.84	18.00
9	Laying and hauling of 20″ and 24″ cast iron "blow-off" line	1,160 lf	.95	.93	2.00
10	Construction of manholes, complete	4 ea	325.00	600.00	250.00
11	Construction of manhole with 4″ pipe connection	1 ea	325.00	600.00	250.00
12	Construction of anchor and manhole	1 ea	1,670.00	925.00	500.00
13	Construction of "blow-off"	1 ea	1,200.00	425.00	750.00
14	Demolition and excavation for Gillespie weir house	lump sum	800.00	800.00	1,000.00
15	Demolition and excavation for Reservoir weir house	lump sum	800.00	800.00	1,500.00
16	Reinforced concrete foundation and weir structure for Gillespie weir house	lump sum	3,000.00	5,300.00	3,200.00
17	Reinforced concrete foundation and weir structure for Reservoir	lump sum	3,000.00	5,300.00	3,500.00
18	Super structure including sidewalks at Gillespie weir house	lump sum	4,500.00	4,100.00	3,500.00
19	Super structure including sidewalks at Reservoir weir house	lump sum	4,500.00	4,100.00	3,500.00

Water Lines, Stoneham, Mass.

OWNER: Metropolitan District Commission, Water Division, Massachusetts.

PROJECT: Furnishing and laying 3,680 ft. of 36 in. steel water pipe and 760 ft. of 36 in. cast-iron water pipe together with necessary appurtenances in Stoneham, Mass.

CONDITIONS: All valves, ironwork required for valve and manhole chambers, and wooden rings for insulation joints will be furnished by the District. District will also furnish and run joint compound for insulation joints and will furnish and set all air valves. Contract was awarded October 29, 1946 and is to be completed November 1, 1947. Wage rates are: crane operators, $2.025; trenching machine operators, $2.025; ironworkers, $1.85; bulldozer operators, $1.65; compressor operators, $1.65; and common laborers, $1.15.

BIDS: Ten bids were received October 24, 1946, ranging from the contract low of $135,870.00 to $260,665.00

LIST OF BIDDERS:

1. Edward M. Matz, Inc., Boston, Mass. (contract) ... $135,870.00
2. Construction Units, Boston, Mass. 148,840.00
3. Wes Construction Co., West Roxbury, Mass. 159,630.00
4. N. Cibotti and S. Andreassi Co., Rosindale, Mass. 159,670.00
5. Rocco Zoppo, Roslindale, Mass. 162,720.00
6. Marinucci Bros. & Co., Dorchester, Mass. 176,115.00
7. Charles Struzziery, Roslindale, Mass. 187,125.00
8. John Williams, Dorchester, Mass. 187,570.00
9. Vincenzo Grande, Brighton, Mass. 194,560.00
10. S. Rotondi, & Sons, Stoneham, Mass. 260,665.00

	Item	Quantity	Unit Prices (1)	(2)	(3)
1	Furnishing and laying 36″ electric welded steel pipe	3,680 lf	$22.00	$25.00	$28.00
2	Furnishing and laying 36″ cement lined cast-iron pipe	760 lf	22.00	24.00	25.00
3	Furnishing and laying 12″, 8″ and 6″ cement lined c. i. pipe for by-pass, blow-offs and air vents	320 lf	10.00	5.25	8.00
4	Furnishing and laying 3½″ fibre cable ducts	5,200 lf	2.00	1.40	1.00
5	Rock excavation above established grade	1,000 cy	10.00	10.00	12.00
6	Rock excavation below established grade	10 cy	20.00	20.00	12.00
7	Earth excavation below established grade	10 cy	5.00	6.00	4.00
8	Chambers for 36″ gate and check valves	6 ea	200.00	475.00	600.00
9	Chambers for blow-off, by-pass and cable ducts	28 ea	150.00	155.00	150.00
10	Chambers for air valves and manholes	7 ea	100.00	120.00	200.00
11	Anchor piers for c. i. pipe in reservoir	60 ea	60.00	89.00	40.00
12	Concrete masonry for foundations and anchorages	100 cy	15.00	15.00	15.00
13	Bituminous macadam pavement	1,300 sy	2.00	3.00	3.00
14	Furnishing and placing gravel	200 cy	2.00	2.00	3.00
15	Furnishing and setting stone bounds	7 ea	20.00	30.00	10.00

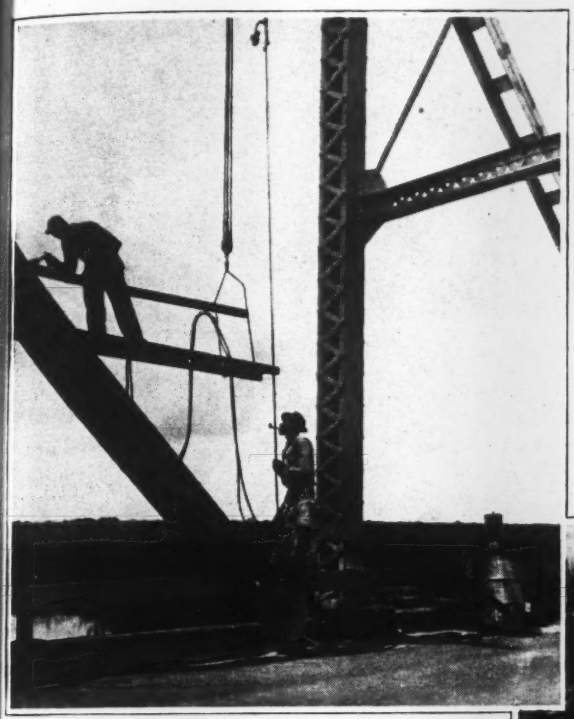
Grenada Dam, Mississippi

OWNER: War Department, U. S. Engineers, Vicksburg, Mississippi.

PROJECT: Construction of a portion of the Grenada Dam embankment, the spillway, and appurtenant work on the Yalobusha River in Grenada County, approximately three miles northeast of Grenada, Mississippi. Work includes: a) site clearing for structures and borrow pits; b) construction of cofferdam in lifts not thicker than 2 ft. to a minimum elevation of 195.0 ft., drainage, and care of river during construction; c) excavation for stripping, miscellaneous grading, and for structures; d) construction of compacted earth fill dam, except for closure section gap, and gap at crossing of highway, railroad, and power line, but including upstream and downstream slope protection and slope drainage section; e) construction of spillway, including approach and outlet channels, weir, chute, and stilling basin and spillway bridge.

CONDITIONS: Contract time is 1,050 calendar days. Failure to complete contract within specified time will result in the assessment of liquidated damages of $500 per day. Wage rates specified are: structural iron workers, $1.625; crane operators, $1.625; reinforcing ironworkers, $1.50; bulldozer operators, $1.50; trenching machine operators, $1.50; truck drivers, over

SPRAY Protective Coatings Direct from Original Drums



Spraying the superstructure of a bridge with paint sprayed direct from the original drum with Alemite VERSATAL equipment.

FASTER . . . EASIER . . . AND AT LOWER COST!

With Alemite VERSATAL Equipment you can pump most any material that seeks its own level in the drum. The powerful VERSATAL Pump will pump materials hundreds of feet horizontally or vertically. VERSATAL Pumps handle Coal Tars, Asphalt Cut-backs and Emulsions, Red Lead, Anti-corrosive materials, Waterproofing materials, Concrete Curing Compounds, some abrasive materials, Sound Deadening materials and many others.

Using VERSATAL equipment to spray underground storage tanks with Bitumastic No. 50.

A Complete VERSATAL set-up:

- VERSATAL pump.
- Hose reel.
- 160' material hose.
- 160' air hose.
- Air compressor.
- Pole gun or spray gun.

Here's what contractors report:

1. **BOSTON, MASS.**... Spraying concrete primer with VERSATAL method, two men increased output from 40 squares to 358 squares per 9 hour day.

2. **HOUSTON, TEX.**... For coating underside domes of gas storage tanks, former hand method required 3 shifts for 18 days... VERSATAL method required 3 shifts for 6 days.

3. **SAN FRANCISCO, CAL.**... For prime coating walls of 2,000,000 gal. reservoir, two men with VERSATAL equipment completed job in 4 hours' spraying time.

ALEMITE Versatal EQUIPMENT

STEWART WARNER

That's Real "Down-to-Earth Moving"!

When it comes to earth moving, those Oliver "Cletrac" crawler tractors are in a class by themselves. The way those babies handle themselves in that rough going is a sight to behold.

My Oliver "Cletrac" dealer was the boy who gave me the dope on stepping up our schedules. "Look," he said, "when you're dozing or scraping, you get an uneven load on the tractor. So you've got to keep jackknifing from side to side to overcome the uneven pull. That is, unless you've got Cletracs on the job. They have an exclusive steering principle that permits them to balance the pull of one track against the pull of the other. You can keep an offset load moving straight ahead . . . there's no wasted motion. And, they are easier and safer to handle on rough, steep and uneven ground."

He had the right angle, all right. Why we've cut our clearing time right down to the bone. The Oliver "Cletrac" dealer sure knows this earth-moving business. He's a good man to know!

OLIVER
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SALES
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Industrial Division: 19300 Euclid Ave., Cleveland 17, Ohio

"THE SIGN OF EXTRA SERVICE"

Grenada Dam, Mississippi

(Continued from preceding page)

3 tons, $0.75; truck drivers, 1½ to 3 tons, $0.70; and unskilled laborers, $0.60.

BIDS: Five bids were received January 10, 1947, ranging from the contract low of $9,154,033.30 to $15,441,503.95. The contract award of January 16, 1947 is 15 percent above the government estimate of $7,952,409.32.

LIST OF BIDDERS:

1. Edward E. Morgan Co., Inc., Jackson, Miss., Jones & Gillis, Inc., McComb, Miss., and Jones-Gillis Contracting Co., McComb, Miss. (contract) $9,154,033.30
2. Pioneer Contracting Co., Inc., Memphis, Tenn. and Oman Const. Co., Nashville, Tenn. 9,395,750.00
3. Forcum-James Co., Dyersburg, Tenn., Hooper Const. Co., Jacksonville, Fla., and H. N. Rodgers & Sons Co., Memphis, Tenn. 9,469,042.50
4. Nello L. Teer Co., Durham, N. C. 9,729,751.75
5. Stebbing Engineering and Salvage Co., Washington, D. C. 15,441,503.95

Item	Quantity	Engineer's Estimate	Unit Prices (1)	(2)
1 Clearing	400 ac	$77.1945	$200.00	$200.00
2 Grubbing	244 ac	232.8457	250.00	200.00
3 Unwatering, drainage, and care of river during construction	lump sum	171,257.29	209,032.00	225,000.00
4 Stripping for embankment	205,000 cy	0.2292	.3275	.30
5 Excavation for drainage ditches and roads	22,000 cy	0.4512	.65	.40
6 Excavation for borrow	8,810,000 cy	0.3081	.3741	.37
7 Excavation for spillway	680,000 cy	0.3413	.4476	.55
8 Excavation for toe drainage system	40,000 cy	0.2870	.65	.75
9 Washing pervious fill material	247,000 cy	1.2373	.75	1.00
10 Compacted fill	7,713,000 cy	0.0737	.098	.10
11 Additional rolling for compaction	1,000,000 sq	0.0077	.0175	.03
12 Backfill, impervious	500 cy	2.1272	3.00	2.00
13 Backfill, pervious	48,000 cy	0.2503	.50	1.50
14 Backfill for toe drainage system	35,000 cy	1.0204	.78	1.00
15 Gravel "C"	2,300 cy	3.9449	6.00	4.50
16 Gravel "D"	1,300 cy	4.1740	6.00	4.50
17 Gravel "R"	112,700 cy	3.7700	3.25	3.50
18 Gravel "S"	1,800 cy	5.7665	6.50	6.00
19 Gravel, ungraded	500 cy	3.5578	6.00	4.00
20 Selected stone	15 cy	7.3013	20.00	10.00
21 Additional harrowing	165,000 sq	0.0762	.075	.03
22 Clay seal	100 cy	3.6318	7.50	10.00
23 Gravel surface course	16,000 cy	3.0451	2.75	3.00
24 Dumped riprap	262,000 cy	7.0499	7.27	7.55
25 Hand placed riprap	12,000 cy	9.7062	8.66	10.50
26 Derrick stone	6,500 cy	9.9564	9.44	9.75
27 Grouting riprap paving	500 sy	3.1299	6.50	5.00
28 Topsoil	150,000 cy	0.5828	.70	.50
29 Spot sodding	370,000 sy	0.0933	.065	.07
30 Strip sodding	1,100 sy	0.1586	.25	.50
31 Solid sodding	81,000 sy	0.4102	.59	.80
32 Corrugated metal pipe, 12"	76 lf	2.3689	3.00	3.00
33 Corrugated metal pipe, 18"	630 lf	4.6524	4.75	4.25
34 Corrugated metal pipe, 24"	516 lf	7.5680	8.00	6.00
35 Corrugated metal pipe, 30"	323 lf	9.6060	10.00	10.00
36 Collector pipe, 48"	2,800 lf	14.4158	14.25	14.00
37 Collector pipe, 54"	2,000 lf	16.2655	18.00	18.00
38 Collector pipe, 60"	1,200 lf	21.1539	24.50	22.00
39 Sewer pipe, 12"	2,000 lf	2.7354	2.25	2.00
40 Sewer pipe, 15"	2,000 lf	3.4066	3.25	2.50
41 Sewer pipe, 18"	200 lf	4.4036	5.00	4.00
42 Culvert pipe, 24"	50 lf	6.4238	7.00	6.00
43 Vitrified clay pipe, 6"	400 lf	0.6897	1.00	1.50
44 Vitrified clay pipe, 6" perforated	1,150 lf	0.7879	1.25	1.60
45 Cast iron pipe, perforated	45,000 lb	0.0898	.25	.20
46 Wrought iron pipe	6,700 lb	0.2075	.35	.30
47 Seepage collector conduits, 12"	310 lf	1.2627	2.75	3.00
48 Seepage collector conduits, 18"	320 lf	2.3687	3.75	4.00
49 Seepage collector conduits, 21"	144 lf	3.2704	5.25	6.00
50 Relief wells	4,900 lf	13.8108	30.00	30.00
51 Plugging 6" wells	2 ea	275.3650	50.00	200.00
52 Drainage wells	850 lf	13.7773	30.00	30.00
53 Manholes for toe drainage system	16 ea	766.7088	700.00	600.00
54 Extra depth of manholes for toe drainage system	4 lf	57.6400	75.00	50.00
55 Gratings and manhole covers	12,300 lb	0.2540	.40	.15
56 Piling, steel sheet, type "A"	35,600 sf	2.1411	2.13	2.30
57 Piling, steel sheet, type "B"	7,785 sf	2.3320	2.13	2.30
58 Mastic cap for piling	750 cf	1.8451	1.65	2.00
59 Portland cement	36,600 bbl	3.1367	3.42	3.50
60 Concrete in spillway approach channel	1,625 cy	13.2666	17.85	16.00
61 Concrete in spillway weir, chute slab, & stilling basin floor	19,440 cy	11.3650	17.35	17.00
62 Concrete in spillway walls	4,780 cy	21.8430	27.30	25.00
63 Concrete in spillway bridge piers	205 cy	27.7040	47.25	50.00
64 Concrete in spillway bridge deck	220 cy	48.8695	63.00	50.00
65 Concrete in miscellaneous structures	350 cy	55.5585	57.75	55.00
66 Concrete in ditch paving	895 cy	15.4397	26.25	35.00
67 Steel reinforcement	1,568,000 lb	0.0643	.0795	.08
68 Copper water stop	7,000 lf	1.2187	2.10	2.50
69 Absorptive form lining	63,000 sf	0.1353	.16	.20
70 Structural steel in spillway bridge	234,400 lb	0.1527	.17	.16
71 Bridge handrail	440 lf	6.8513	14.20	10.00
72 Wall handrail	250 lf	6.7294	14.20	10.00
73 Metalwork, miscellaneous	21,200 lb	0.1384	.32	.40
74 Flap gate, 18"	1 ea	37.74	42.00	60.00
75 Copper inserts	200 lb	1.0617	1.56	1.00
76 Dismantling and miscellaneous work	lump sum	54,606.85	50,000.00	30,000.00

Reinforced Concrete Bridge at Cherryvale, Kansas

OWNER: State Highway Commission of Kansas; R. C. Keeling, State Highway Engineer.

PROJECT: Construction of bridge to span railroad crossing at Cherryvale, Kansas. Bridge to be of continuous reinforced concrete slab spans, 32'—42'—46'—46'—42'—32'.

CONDITIONS: Access to job site is by railroad or U. S. Highway 160. All materials to be furnished by contractor. Contract time is 140 working days. Skilled wages range from $1.00 to $1.50 per hour; semi-skilled from $.80 to $1.00; and common labor, from $.60 to $.80.

BIDS: Five bids were received November 2, 1946, ranging from the contract low of $79,763.08 to $89,257.40.

LIST OF BIDDERS:

1. E. W. Geiger, Leavenworth, Kansas (contract) $79,763.08
2. C. E. Maxwell & Son, Columbus, Kans. 80,397.70
3. F. H. Freeto, Pittsburg, Kans. 81,020.40
4. Inland Const. Co., Omaha, Nebraska 83,652.00
5. Carrothers Const. Co., Paola, Kans. 89,257.40

Item	Quantity	Unit Prices (1)	(2)	(3)
1 Class III excavation	1,045 cy	5.50	7.00	8.00
2 Class AA concrete	1,311.4 cy	37.00	37.00	36.00
3 Reinforcing steel	288,620 lb	.074	.07	.075
4 Structural steel	11,080 lb	.23	.25	.20
5 Bearing devices	3,175 lb	.50	.50	.50

Outfall Sewer Line Extensions, Sacramento County, California

OWNER: Sacramento County, Sanitation District 1, E. A. Fairbairn, County Engineer; Harry N. Jenks, Consulting Sanitary Engineer.

PROJECT: Installation of 15", 18", and 24" outfall sewer line extensions along Fruitridge Road from 45 Ave. to Power Line Road in Sacramento County.

CONDITIONS: The Sanitation District will furnish all pipe. Transportation is available by both rail and highway. Contract time is 100 calendar days. Minimum wage to be paid on job is $1.25.

BIDS: Only two bids were received December 23, 1946, the low bid of $58.526 and the high bid of $79,748.75.

LIST OF BIDDERS:

1. A. Teichert & Son, Inc., Sacramento, Calif. (contract) $58,526.00
2. Steve P. Rados, Los Angeles, Calif. 79,748.75

Item	Quantity	Unit Prices (1)	(2)
1. Install 24" vitrified clay sewer pipe complete in place	3,465 lf	$5.90	$6.50
2. Install 18" vitrified clay sewer pipe complete in place	3,700 lf	3.20	5.10
3. Install 15" vitrified clay sewer pipe complete in place	5,825 lf	2.90	4.25
4. Construct standard manholes	34 ea	275.00	400.00

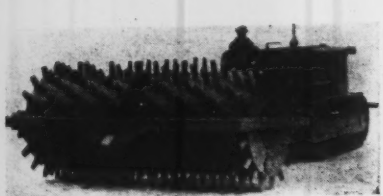
New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

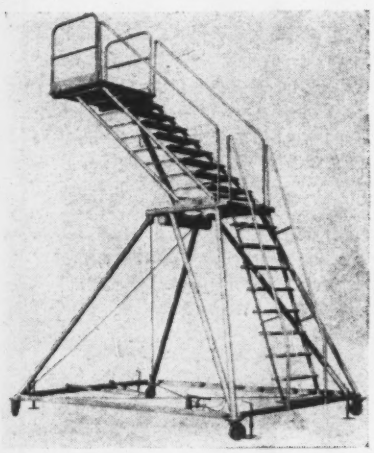
AIR-HOSE — Black Wing cord line, water and air hose is built in ¾- to 2½-in. sizes. Horizontally braided, exclusive method of bonding cover, carcass and tube together gives hose rope-like flexibility and yet retains maximum ruggedness. Black Wing air hose is manufactured in two types—two-braid standard for pneumatic tool service and three-braid heavy-duty for air drill usage. Sizes range from ⅜- to 1½ in. Both products utilize cabled cotton body for greater carcass strength and sturdy, seamless tube unaffected by lubricants which often cause swelling and flaking.—*Goodyear Tire & Rubber Co., Mechanical Goods Division, Akron, Ohio.*

RAILCAR COMPRESSOR—A railcar compressor for mine and tunnel work is mounted on a welded structural steel chassis. The unit is available in 60-105-160-210-315 cfm. capacities. The two stage compressor is directly connected to a gasoline engine, diesel engine or electric motor. Gas and diesel machines include a throttle control and unloader which automatically regulate pressure and acceleration. Electrically-driven units have automatic controls and explosion-proof electrical equipment.

Cars are manufactured for either standard or narrow gage track. Springs and wheels are standard mine car type. Axle assemblies are ball-bearing equipped and sealed against dust and dirt. Standard equipment includes heavy metal canopy with open sides and doors, tool box and kit. In addition 60 and 105 cfm. machines can be furnished in single stage construction. Self-propelled rail cars can be furnished on special order.—*Davey Compressor Co., Kent, Ohio.*

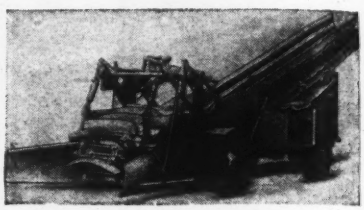


HEAVY-DUTY TAMPING ROLLER—New tamper applies 335 psi. when empty and can be used at any weight up to 800-lb. maximum. Model G-2 is designed to meet compaction requirements of such varied jobs as earth dams, airport runways and highways. Average pressure on each foot varies as follows: Empty drums, 2,350 lb.; water-filled drums, 4,000 lb.; and wet sand-filled drums, 5,660 lb. It is easy to tow and has shipping weight of only 18,800 lb. Oscillating-type roller consists of two 76-in. drums, designed around full-floating pole, which allows for full individual drum oscillation. Diamond tapered feet give easiest penetration with least disturbance to surrounding material. Drums are surrounded by box-type frame, centered on the drum axle to prevent off-center loads, but pole is so mounted on each as to produce straight line pull with tractor drawbar. Each roller has stationary welded axle, supported on each end with self-aligning ball bearings, dust and dirt sealed and pressure-lubricated. Drum cleaner teeth are constructed of heavy duty channel steel. Tamper has been constructed to penetrate to bottom of soil layer and start its compaction from bottom.—*Wm. Bros Boiler & Mfg. Co., Milwaukee, Wis.*

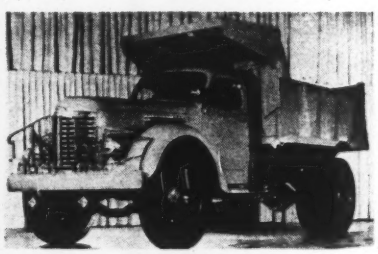


ADJUSTABLE WORK STAND—Aerostand, the hydraulically operated adjustable work stand eliminates scaffolding. A 16-sq. ft. work platform, with a maximum static load capacity of 1,500 lb., it is hydraulically elevated or lowered to any working level from 3 to 24 ft. The unit features exclusive and patented use of automatic and self-adjusting steps which maintain their position parallel to the ground.

Scaffolding strips, stand extensions and hoist attachments are general utility features. All models are equipped with guard rails and skid proof surfaces on platforms and steps. Frames of welded tubular steel are mounted on swivel casters with caster locks. Truck locks hold stands stationary when in service. Two bars, scaffold strips, stand extensions and hoist attachments are optional equipment.—*Airquipment Co. Dept., GE, Burbank, Calif.*



FORCE-FEED LOADER—Model 3 is used on such jobs as road winding and resurfacing, ditch building and cleaning, dressing slopes, loading oil mix, etc., and works as companion tool for Caterpillar Motor Grader. With fingertip hydraulic control, it provides four levers for raising and lowering feeder, moldboard, throat and conveyor. New model also features roomy operator's platform, new conveyor and throat design, positive belt alignment, more accessibility and greater loading efficiency. —*Athey Products Corp., 5631 W. 65th St., Chicago 38, Ill.*



NEW TRUCKS—Four new trucks have been added to International's line: Model KB-8-5 chassis, with 179, 197 or 215-in. wheelbase, is a heavy-duty, four-wheel drive six-wheeler, powered by a Red Diamond, 361 cu. in. displacement engine. Model KB-1 with pickup body has 113 or 125-in. wheelbase, powered by a 6-cylinder Green Diamond engine. Model KBR-11, with 6 cu. yd. body and cab protector and 149, 161, 179 or 197 in. wheelbase, uses 451 cu. in. displacement valve-in-head Red Diamond en-

NO-OX-ID OFFERS BETTER PROTECTION FOR Pipe

Moisture protection has gone modern . . . for pipe as well as for humans. Many long-accepted specifications, now known to be mere "coatings," stand outmoded. *Scientific* rust inhibited films, like NO-OX-ID, take their place to assure *positive* moisture protection, corrosion prevention for *a pipe lifetime.*

USED AS COATING AND LINING

Line or coat your pipe with resilient, nondrying NO-OX-ID. It makes an intimate and lasting bond with iron or steel; has high dielectric strength; is tasteless, odorless.

Protection of war material required highest quality inhibited protective coatings. For this reason the greater proportion of NO-OX-ID was allocated for this use. Now NO-OX-ID is in civilian service again. Specify Water Works NO-OX-ID No. 2 . . . and get the best.

NO-OX-ID IRON RUST
REG. TRADEMARK AUG. 27, 1918

The ORIGINAL RUST PREVENTIVE

Dearborn Chemical Company
Dept. ER, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

...FOR DUST

This self-supporting butt welded steel dust collector, 250 feet high, was built by Ingalls for the National Carbide plant at Louisville, Ky. It is the largest structure of its kind in the nation.

Consult Ingalls for your fabricated steel needs, large or small. Complete erecting service provided, if desired.

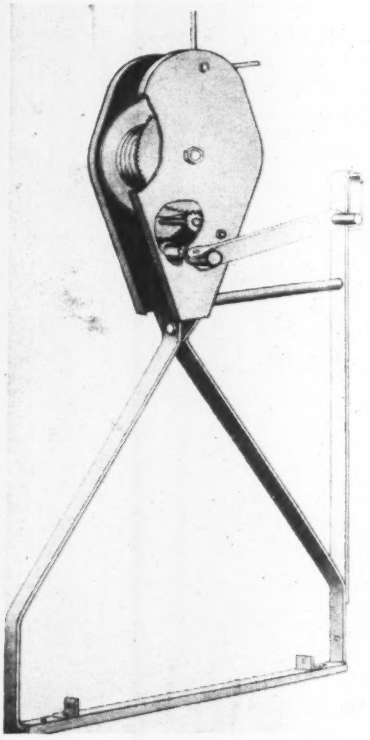
INGALLS
STEEL

THE INGALLS IRON WORKS COMPANY

THE INGALLS SHIPBUILDING CORPORATION

The Steel Construction Company, Birmingham Tank Company. Offices at BIRMINGHAM, Pittsburgh, New York and New Orleans. Fabricating plants at Birmingham and Pittsburgh. Shipyards at Pascagoula, Miss., and Decatur, Ala.

gine. Model KB7, 134, 146, 158 or 176 in. wheelbase, with 3-way hoist and round front end 3 cu. yd. dump body, uses 269 cu. in. displacement Blue Diamond engine.—*International Harvester Co., Motor Truck Division, 180 North Michigan Ave., Chicago 1, Ill.*



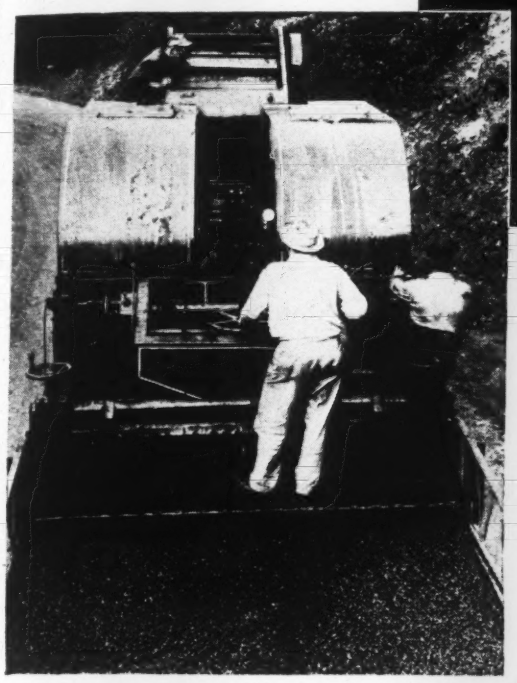
SWING STAGE—To men working above ground level, three things are important—safety, ample working space and a quick, easy means of ascent and descent. The new Safway Saf-T-Swing stage guarantees all three. It is a light duty swing stage especially designed for maintenance work, painting, cleaning, etc. The Saf-T-Swing offers great safety, due primarily to its completely new winch design. It is entirely gear operated.

The swing consists of two winches each equipped with 150 ft. of cable. A stirrup which will take a platform up to 28 in. in width is bolted to each winch and can be removed for easy storage. A guard rail post is welded to each stirrup. A steel gear housing prevents foreign matter from entering the gears and gives added protection to the operator.—*Safway Steel Products, Inc., Milwaukee, Wis.*

WINTER AIR CONDITIONER — The "Warmaire" oil-fired winter air conditioner is a specially designed unit to meet the current demand for mass-production heating equipment in veteran housing projects, prefabricated homes,

At Right: Moto-Paver mixing and laying retread pavement over old bituminous macadam in West Virginia.

Below: Rear view showing positions of the men usually used in operating the Moto-Paver.



For resurfacing secondary roads and city streets... Also for new construction

● The H & B Moto-Paver is especially adapted for resurfacing secondary roads and city streets, but is also highly efficient on new construction. Here, for the first time, is a self-contained, single-unit machine which accomplishes the entire mixing and laying job in one continuous operation. The Moto-Paver delivers the mixed material spread and struck off on the road surface, ready for rolling. Paving width is adjustable from 8′6″ to 12′0″, and thickness up to a maximum of 7″. The strike-off blade is adjustable to hold accurately to specified grade and crown.

The Moto-Paver has been successfully operated using gravel, stone or slag aggregates, and with most types of emulsions, RC, MC, and SC asphalts and tars. Illustrated bulletin giving complete information and specifications will be sent on request.

HETHERINGTON & BERNER INCORPORATED
730 KENTUCKY AVENUE, INDIANAPOLIS 7, INDIANA

Moto-Paver
THE COMPLETE TRAVELING MIXER AND PAVER

25 WHITCOMB LOCOMOTIVES

Aid IN RESTORING DEMOLISHED DYKES • • •

When the war ended in Holland the dyke system which is so vital to the economy of that country was practically destroyed. This allowed the sea water to envelop thousands of tillable acres upon which Holland depended for its very existence. Not only was it impossible to cultivate the soil with 4 to 8 ft. of water on it, but if the sea water with its highly salt content was allowed to remain for any length of time — it would take from 6 to 8 years for these submerged acres to regain their normal fertility.

Here was a dirt moving job that had to be done and done in a hurry. Each day, yes each passing hour, made an important difference in the outcome of the job. That's why these small but powerful 5 ton Whitcomb Diesel mechanical locomotives were chosen for the work—chosen over all other makes of locomotives and over all other methods of moving a lot of dirt in a hurry.

These Whitcomb locomotives had to be light in weight to operate over narrow gauge, uneven, temporary road beds and light rail. They had to be powerful enough to haul a definite tonnage (47 tons trailing load) over an undetermined profile with grades up to 6%. And because of the importance of the time element *these locomotives were scheduled to work 24 hours, every day until the job was completed.*

War tested applications have proven that dirt—lots of dirt, can be moved quickly and in many cases more economically by Whitcomb locomotives, than by any other type of motive power. Let Whitcomb engineers recommend the locomotives that will exactly meet the requirements of that next big dirt moving job—they may be able to make considerable money for you.

A WORD from you will bring new illustrated bulletins, describing Diesel mechanical and Diesel electric locomotives from 3 to 80 tons.

•

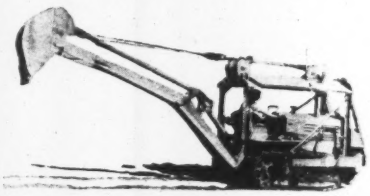
BLW THE BALDWIN GROUP

THE WHITCOMB LOCOMOTIVE CO.

PARK & RECORD STS. ROCHELLE, ILL.

Subsidiary of THE BALDWIN LOCOMOTIVE WORKS

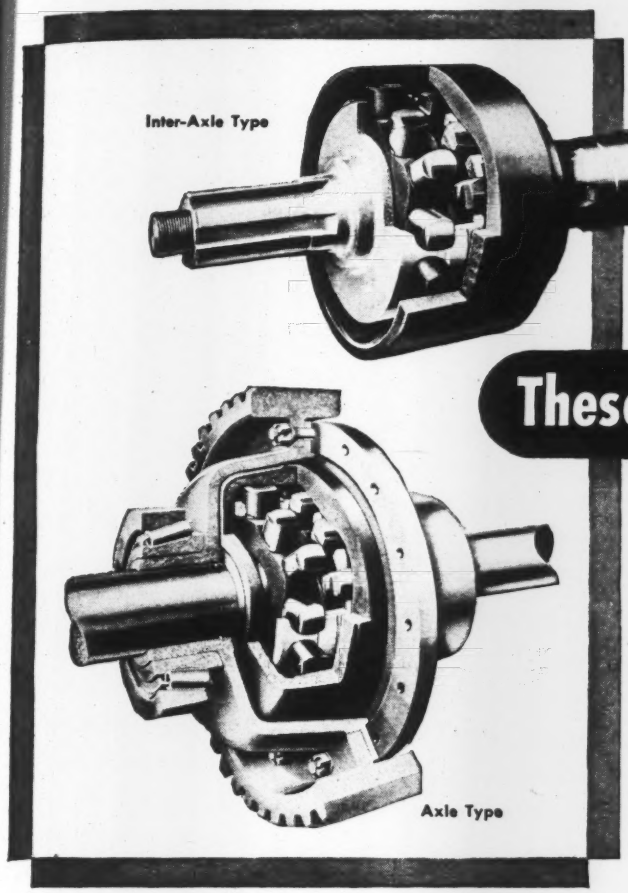
etc. It is a completely packaged unit. Four simple connections—electrical, thermostatic, stack, and oilline—make it ready to operate. Only 25 in. square at the base, it stands 5 ft. high. Its capacity is 65,000 BTU-per-hr., fuel consumption, 62/100 gal-per-hr.—*York-Shipley, Inc., York, Pa.*



TRACTOR BACKHOE—The Sargent backhoe consists of a permanent tractor hook-up attachment plus a boom and special ditch-digging bucket which substitute for the regular shovel arms and bucket of the overhead shovel. The attachment weighs 165 lb. and can be attached by one man in one hour. It does not interfere with the use of the tractor for other purposes so that it has to be put on only once. The backhoe boom and bucket, weighing 1,435 lb. for the Model B, can be attached in one hour and can be detached in about 10 minutes.

The backhoe bucket is equipped with an automatic bucket cleaner that cleans the bucket at every dumping. Dumping of the bucket is either manual or automatic. Maximum digging depth is between 7 and 8 ft. depending upon type of material. At the present time the back-hoe is available in two sizes, Model B and Model D, to fit Cletrac tractors. —*Maine Steel, Inc., South Windham, Maine.*

CARBON MONOXIDE ALARM — Alarm operates continuously, giving both visible and audible warning when carbon monoxide concentration reaches predetermined level. Settings can be made for concentrations as low as .02 percent at which several hours' exposure would be required to product first symptoms of carbon monoxide poisoning. Unit draws continuous sample of surrounding air and forces it over catalyst which oxidizes all carbon monoxide to carbon dioxide. When concentration reaches meter setting alarm horn sounds and red light jewel is illuminated; both continue to operate until instrument is manually reset. In a weatherproof case, alarm requires only connection to proper rated source of power. It consumes no more current than 100-w. bulb and is equipped with brackets for wall mounting.—*Mine Safety Appliances Co., Pittsburgh 8, Pa.*



These lick tough terrain...

These are the two types of the Mack Power Divider...another exclusive Mack development...the best way yet devised for preserving traction on slippery ground.

Positive traction with true differential action is assured by the Mack Power Divider. It contains no gears. It exerts no end-thrust. It is designed to transmit more torque to wheels maintaining traction...less torque to slipping wheels.

Serving as a third differential, the Inter-Axle type is used in all Mack four-wheel drive bogies for six-wheelers. It is a means of dividing power between the driving axles. This allows speed differences between the axles and makes up for unevenness in road or tires.

In either four- or six-wheel Macks for off-highway service, the Axle-type replaces the conventional differential, with which it is interchangeable.

The Power Divider is another example of how Mack designs and builds trucks down to basic working parts to meet specific job demands.

Trucks for every purpose

Mack **since 1900, America's hardest-working truck**

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts. In Canada, Mack Trucks of Canada Ltd.

THIS BIG, fast and powerful new Mack model LR 15-ton dumper, is one of several in the service of **Marquette Cement Manufacturing Co., Cape Girardeau, Missouri.**

FORMULA No. 640

a clear liquid waterproofing for old or new construction

PENETRATES

deeply—one inch or more—is not a surface treatment. Brush, spray, or float on stone, cast stone, concrete, mortar, stucco, tile, brick, plaster, wood, wall board — any absorbent material.

WATERPROOFS,

preserves, prevents dusting of floors, surface dirt washes away in rain.

FORMULA NO. 640

is a balanced formula of seven different waxes and resins in a hydrocarbon solvent.

ACID-ALKALI proof

does not oxidize, unchanged by temperature.

PERMANENCE

it is our opinion it will last as long as the concrete, mortar, stucco, etc. lasts.

OIL PAINT

saponifies on cement unless sealed first with Formula No. 640.

APPLY to either side:

The pressure side, or opposite side —it is equally effective.

HYDROSTATIC PRESSURE

a 20 foot head has been held by Formula No. 640.

CUTS WATERPROOFING COSTS

because it applies three times as fast as paint, requires no special technique.
No preparation — comes ready to apply.
Eliminates necessity of furring.
Concrete floors and walls need no membraning.

Keeps in all climates
Harmless to use
Good coverage
Moderate price

Write our Engineering Department for office test kit, technical data, or regarding any special problem.

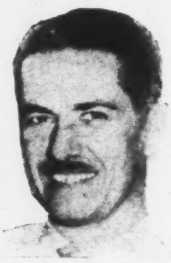
J. Wilbur Haynes, Engineer

OTHER PRODUCTS: Formula No. 640 Toxic, combines waterproofing with termite and fungus protection; cement hardener; floor mastic; roof coatings, etc.

HAYNES PRODUCTS CO.
4007 Farnam St.
Omaha 3, Nebr.

MEN AND JOBS

The Clay Sewer Pipe Association Inc., has announced the appointment of **Edward W. Hartman** of Akron, Ohio, as district representative for the Ohio area. Mr. Hartman formerly served as draftsman for the Republic Steel Corp; transportation consultant to the Mexican government; and senior engineer for the Rubber Development Corp., stationed in Brazil. Prior to that he was assistant engineer for the Ohio Highway Department for a number of years. Mr. Hartman also spent three years in Liberia as construction engineer for the Firestone Corp. Headquarters for Mr. Hartman are located in the main office of the Clay Sewer Pipe Association at 1105 Huntington Bank Building, Columbus, Ohio.



J. Mitchell Garrison has been named acting city planning engineer for Omaha, Neb., succeeding **Rodney E. Gibson,** who leaves shortly for a position with the Civil Aeronautics Administration at Kansas City, Mo. Mr. Garrison has been with the Omaha office of the United States Engineers for the last six years, and formerly was city engineer at Louisville, Colo. He received his B. S. degree at West Kentucky State College.

F. W. Sarvis, Sigourney, Iowa, has been appointed county engineer for Henry County with headquarters at Mt. Pleasant, Iowa, succeeding **M. H. Bryant,** resigned. Mr. Sarvis was graduated from Iowa State College at Ames, Iowa, in 1914.

S. M. Helgeland, Ankeny, Iowa, has been appointed county engineer of Chickasaw County. Iowa, with headquarters at New Hampton, filling a vacancy created by the death of E. W. Hahn last August. Mr. Helgeland was formerly county engineer for Humboldt County, Iowa.

Donald Schoeferlin, Gowrie, Iowa, has been appointed county engineer for Humboldt County, Iowa, with headquarters at Dakota City. He succeeds **Verner Miller** resigned.

Lawrence N. Lydick, Kansas highway department resident engineer on the U. S. highway No. 50 construction project in northeast Johnson County, has resigned to accept an appointment as engineer for Mission Township.

Walter E. Bedinger, Jr., a civil engineering graduate of the Georgia School of Technology, is now with the H. S. Holtze Construction Co. general contractors of Sioux City, Iowa, and is to have charge of the construction of sewage disposal plants.

Walter D. Guy recently resigned as Cowley County, Kan., engineer, **Crawford Stevens,** member of the county engineering staff, will succeed Mr. Guy.

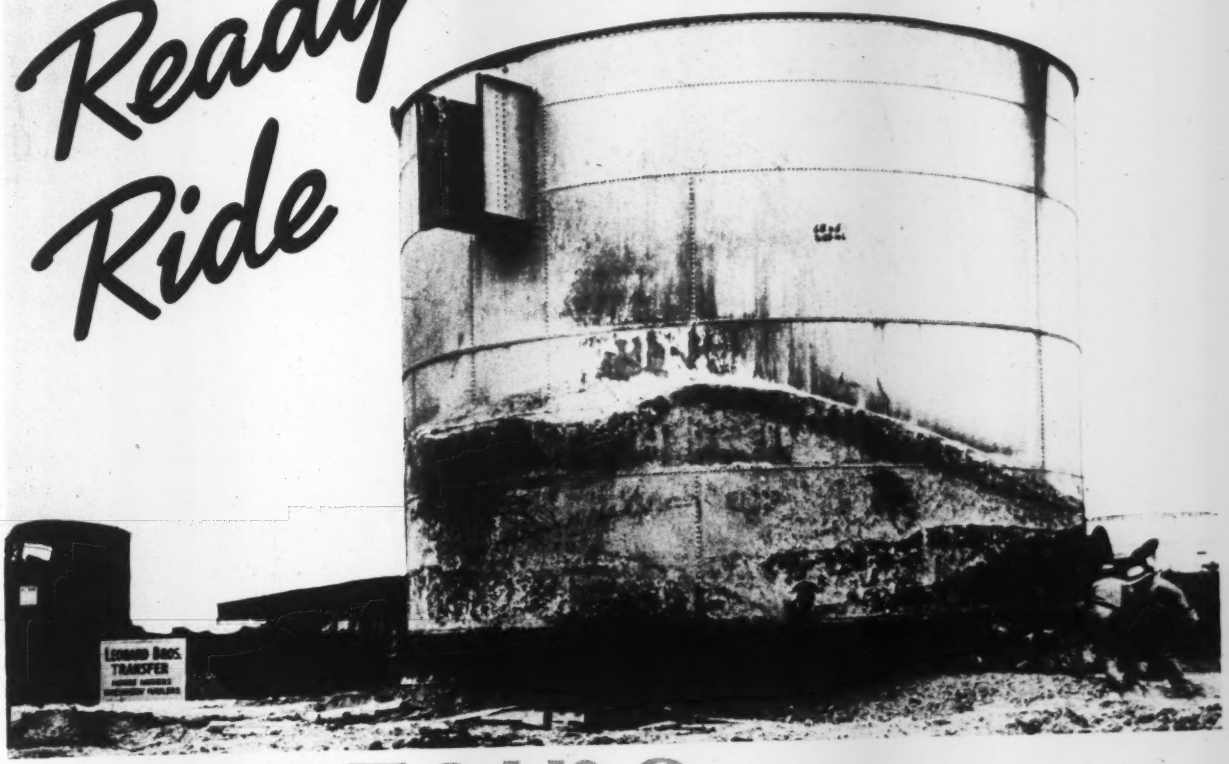
Gail L. Barnard is retiring after 40 years service with the engineering department of Jacksonville, Fla., to enter the practice of civil engineering and surveying. He has been topographical engineer for the city.

Walter M. Kunsch has returned after two months leave of absence to his duties as engineer-manager of the Urbana-Champaign Sanitary District in Illinois. During his absence, **E. M. Anderson,** of the firm of Wilson and Anderson, Champaign, acted in the position.

I. P. Macnab, of Halifax, N. S., has been appointed manager and chief engineer of the Public Service Commission of Halifax, which administers the water and sewerage services. He succeeds **H. W. L. Doane,** who resigned to return to the Standard Paving (Maritimes) Ltd., Halifax, as manager and engineer.

The election of **Nelson L. Doe** as a vice-president of the Turner Construction Co. of New York, has been announced. Mr. Doe took a 5-year course at Dartmouth College and the Thayer School of Engineering, receiving the degree of B.S. in 1912 and C. E. 1913. On April 27, 1913, he reported to the Turner Construction Co. as material clerk on the General Electric Building under construction in Pittsfield, Mass. In 1924 he was appointed general superintendent in the New York territory, serving until 1933. From then until

Ready to Ride



FONTAINE Trailers

always Ready to take the **Big Ones**

Immediate Delivery
on Several Models
(30 days on any model)

Any Capacity up to 100 tons

Fontaine low bed trailers are specially designed to haul the heavy loads. The main frames are very rugged. The air brakes are given extra braking surfaces. And every model comes full equipped . . . ready to go to work.

Write for catalogue and name of nearest distributor

Fontaine Truck Equipment Co., Inc.

3827 FIRST AVENUE, NORTH
BIRMINGHAM 6, ALABAMA

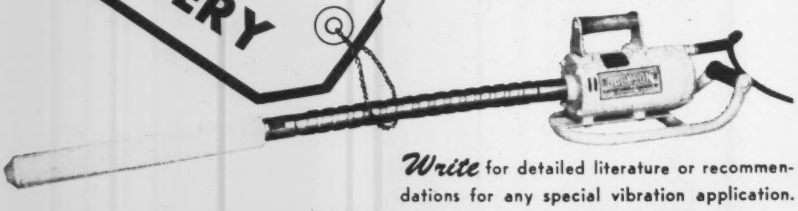
The JACKSON FS-7A AN AMAZINGLY VERSATILE CONCRETE VIBRATOR (ELECTRIC)

Ideal for
THIN WALLS
•
HEAVY RE-INFORCED SECTIONS
•
HARD TO-GET-AT PLACES
and
MANY JOBS FORMERLY HANDLED ONLY BY LARGER VIBRATORS

NOW READY FOR DELIVERY

You're making no mistake when you put this vibrator at the top of your equipment requirements list; for with just the price of one machine invested, you're thoroughly equipped to handle a wide variety of jobs to best advantage. The motor weighs just 28 lbs., yet it will handle efficiently any of our standard heads up to 2⅜" x 18½", with flexible shafting of 24", 36", 7' or 14' lengths — delivering 7,000 to 10,000 vibrations per minute, depending on the length of shaft, size of head and consistency of concrete. Operates on AC or DC, 110-120 volt standard commercial power, single phase or Universal tools, and may be plugged into light socket or power plant. Vibrator head interchangeable with grinding attachment.

MODEL FS-7A



Write for detailed literature or recommendations for any special vibration application.

ELECTRIC TAMPER & EQUIPMENT CO. LUDINGTON MICHIGAN

1940 Mr. Doe was superintendent in charge of some of the company's most important operations, including the Rockland and Pilgrim State Hospitals and the General Motors "Futurama" at the New York World's Fair. On Dec. 1, 1940, he was re-appointed general superintendent in the New York area. He has since had general supervision of important operations, including the Admiral Taylor Testing Basin at Carderock, Md., Johns-Manville Laboratory, United States Gypsum paper mill, Sears, Roebuck work, and other projects.

Rowland M. Jones, Douglas County engineer at Waterville, Wash., for the last two years, has been appointed Kittitas County engineer at Ellensburg. He previously had been employed in the engineering department of the Northern Pacific Railroad. Jones succeeds **Don Akins,** who resigned.

The Seattle, Wash., Municipal Board of Public Works has adopted a resolution of appreciation for the 41 years of municipal service of **E. D. Alexander,** retiring senior civil engineer in the city engineering department. Now 67, Alexander retired March 1.

James H. Ramsey, senior hydraulic engineer of the canals branch of the Department of Transport at Ottawa, has been named superintendent engineer of the Welland Canal, with headquarters at St. Catherines, Ont. He succeeds Carl West, new director of canal service at Ottawa.

W. F. G. Wallace, chief draftsman in the Jacksonville, Fla., city engineering department, has retired after 22 years of service.

Donald Hernandes has recently been named sanitary engineer of the DuPage County Health Department at Villa Park, Ill.

V. R. Smitham, city manager of Dallas, Tex., has resigned, effective April 30, to enter private business. He has a Texas A. and M. College civil engineering master's degree, and is president of the International City Managers Association. He has served as city manager of Big Spring, Lufkin, and Wichita Falls, Tex.; county engineer of Rockwall County, and assistant county engineer of Collin County; and state director of the Farm Security Administration.

Harris Lund and **Jack Kalman** have recently been employed as civil engineers with the Illinois Aeronautics Department, Springfield. Lund had been an engineer with the War Department

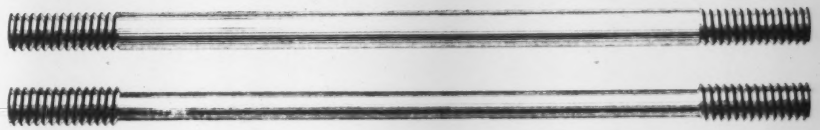
DEPENDABLE FASTENINGS for the Construction Jobs Ahead

Here are the fastenings, both plain and galvanized, being turned out by Bethlehem for the big construction jobs ahead. Tough and rugged, and made to exacting specifications, Bethlehem fastenings are the kind you can count on for dependable performance. And Bethlehem fastening engineers are always at your service, ready to discuss your fastenings problems.

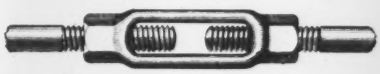
DRIFT BOLTS—Furnished round or square, either headless, or with button, countersunk or square heads. Points manufactured are wedge, half or semi-cone, full-cone, no point.

SPIKES—Easy to drive because of their sharp wedge points. Made with diamond, button, nail, countersunk and hook heads.

WASHERS—Furnished round in two styles, standard and dock. Square and rectangular washers may be obtained on special order.



TIE RODS—Supplied plain or upset in all sizes, in single or multiple units, and with cut or rolled right- or left-hand threads. Single unit rods are made in lengths up to 46 ft, but multiple units can be supplied in any length. Bethlehem also manufactures a complete range of tank- and pipe-bands.



TURNBUCKLES—Bethlehem turnbuckles are furnished in a size range to meet every requirement. Standard 6-in. openings are furnished between heads, but 12-in. openings can also be supplied.

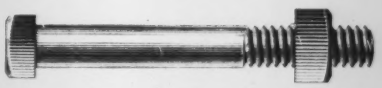
★ BETHLEHEM STEEL ★

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

CLEVISES—Made in a full range of sizes, tapped to American Standard Coarse-thread Series, Class 2. Furnished with or without pin and cotter, and with right- or left-hand threads.

RIVETS—Furnished in all standard types, small and large.

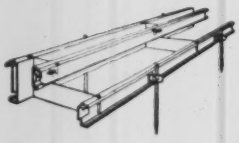


MACHINE BOLTS—Manufactured from carbon or alloy steel in all sizes. Furnished with cut- or rolled-threads, and with square, hexagon, tee, button, countersunk and hook heads. Carriage and lag bolts, as well as all types of special bolts, are also supplied in a full size range.

Bethlehem supplies every type of Fastening

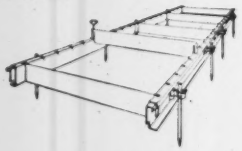
STEEL FORMS

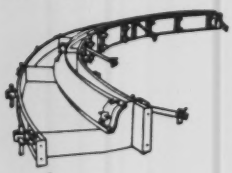
Curb Forms... Sections 10' long for either straight face or battered face construction. Steel forms for all special concrete curbs.



Combined Curb and Gutter Forms... Each 10' section consists of 1 each of back curb form, front gutter form and face curb form, also 2 each of face curb form supports, round stakes for back form and round stakes for gutter form.

Sidewalk Forms... 10' sections, slotted 12" for division plates, which are removed without disturbing side forms after concrete takes its initial set.





Rigid Radius Forms... Used for building concrete curbs or curb and gutters when all intersections or corners must match. Heltzel forms made in sets to form a specified radius.

Flexible Forms... Used when building radius curbs, curb and gutters or sidewalks where the radius is subject to frequent change or for serpentine work in park areas.

Heltzel Steel Form & Iron Company, Warren, Ohio

SEND ME STEEL FORM CATALOGS:

[ ] B-19 Steel Highway and Airport Forms

[ ] B-19A Steel Dual Duty Airport Forms

[ ] A-20 Steel Forms for Curbs or Curb and Gutters or Sidewalks.

Name_____

Address_____

_____

(Type of construction usually engaged in)

HELTZEL STEEL FORM & IRON CO. WARREN, OHIO · U. S. A.

CONCENTRATED *Engineering* **IN CONCRETE CONSTRUCTION**

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- BINS, Portable and Stationary
- CEMENT BINS, Portable and Stationary
- CENTRAL MIXING PLANTS
- BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
- BITUMINOUS PAVING FORMS
- ROAD FORMS (with lip curb and integral curb attachments)
- CURB FORMS
- CURB AND GUTTER FORMS
- SIDEWALK FORMS
- SEWER AND TUNNEL FORMS
- CONCRETE BUCKETS
- SUBGRADE TESTERS
- SUBGRADE PLANERS
- TOOL BOXES
- FINISHING TOOLS FOR CONCRETE ROADS

and Kalman with the U. S. Army Engineers.

Harry A. Gerard has been appointed airport engineer of the Civil Aeronautics Administration for Kentucky.

W. B. Robison has been appointed engineer of Division 2, Toledo, of the Ohio highway department, succeeding Arnold V. Finch.

Ernest L. Boggus, Atlanta, Ga., has opened his own business as civil engineer and surveyor, with offices at 75½ Hunter St., S. W. He was formerly with the United States Geological Survey, General Land office, U. S. Resettlement Administration, and the division of planning of the Georgia Highway Department. He is a graduate of Emory University.

Frederick T. Thorpe, Jr., has been appointed chief engineer and surveyor in the Bureau of Engineering Surveys and Zoning for the Phildelphia. Pa., area. He succeeds A. Zane Hoffman, recently named chief of the bureau, who in turn succeeded Thomas Buckley upon the latter's becoming director of public works.

Philip P. Snow has opened a structural engineering office at 193 Middle Street, Portland, Me.

E. R. Boyce, district maintenance engineer for the Minnesota State Highway Department at Virginia, has been transferred to district maintenance engineer at Rochester, **W. N. Bement** has been appointed district maintenance engineer at Virginia. Mr. Boyce will succeed **Mark Brataas,** recently promoted to district engineer with headquarters at Rochester. Mr. Bement has been project engineer at Virginia.

W. O. Weir, Saybrook, Ohio. former Ashtabula County engineer, has been appointed construction engineer for the Ohio Highway Department in that county, with headquarters in Ashtabula.

Frederick H. Sexton, founder of the Novia Scotia Technical College and its president for 40 years, has retired and is succeeded by **Alan E. Cameron,** Deputy Minister of Mines for Nova Scotia and former president of the Association of Professional Engineers of Nova Scotia.

Walter C. Surtees, assistant chief of the Aids to Navigation section of the Department of Transport of Canada, has retired after 46 years of continuous service. He had done special work in the design of many of the lighthouses around the seacoasts of Canada.

A king size 3/4 Yd. Machine

Power, strength, mobility, lifting capacity, adaptability —you get more of each in the 3/4 yd. Lorain-41 than in other units of like capacity.

Check the features listed here—score them point for point against the field in the 3/4 yd. class. You'll get the same answer as have hundreds of other shovel and crane users—the Lorain-41 has more "capacity for profits" than any machine of its class. See your local Thew-Lorain distributor for complete information now!

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LORAIN, OHIO

TURNTABLE FEATURES

Simplified Center Drive direct-to-the-point power application on turntable.

Sloping machinery frame places machinery far back of tipping point where it counter-balances loads for maximum lifting ability.

Roller bearing mounted Swing Drums, actuated by long life shoe clutches.

Steel Erector's Precision Boom Hoist, with "Micrometer" power control of boom lowering (on cranes).

Easily assembled pin-connected crane booms, with center sections and extension tips.

Independent, positive chain crowd shovel boom.

"Cable-Miser" dragline fairlead prolongs cable life.

CRAWLER FEATURES

Heavy-duty chain drive.

2 travel speeds—in both directions—provided as standard equipment, no extras.

Crawler steers from operator's position with turntable in any position of swing.

A positive 4-way tread and travel lock.

Drop forged treads, 30" wide, swamp type, self-cleaning.

Thew Lorain 41

New!

ELECTRICALLY OPERATED RECEIVER

Builders Totalizer, Indicator, Recorder

TOTALIZES • INDICATES RECORDS FLOW

Over any distance

INSTALLS ON PROPELOFLO OR ANY MECHANICAL METER

Builders new electrically operated transmitter and receiver greatly broaden the applications of any mechanical flow meter. No longer is it necessary to go into manholes and inaccessible locations to read a meter. Complete chart records and rate of flow as well as exact total of flow can now be had at any point, however remote. The recording chart has uniform graduations throughout its range — a special Builders feature. Alternating current is used at the receiver; no power required at the meter.

Builders Propeloflo meter is well adapted to remote operation . . . ***only two wires are needed*** to transmit flow information to the main building. The new transmitter greatly broadens the usefulness of the Propeloflo, already extensively used as a main line meter. The streamline Venturi design of this Propeloflo meter creates uniform velocity distribution where the flow meets the propeller, giving exceptional accuracy over a wide range with low head loss. For Bulletin C11-380.21, address Builders-Providence, Inc., (Division of Builders Iron Foundry), 51 Codding St., Providence 1, Rhode Island.

BUILDERS—PROVIDENCE
Instruments

Builders Propeloflo Meter with Transmitter

BUILDERS PRODUCTS

Venturi Propeloflo and Orifice Meters • Type M and Flo-Watch Instruments • Venturi Filter Controllers and Gauges • Master Controllers • Wheeler Filter Bottoms • Kennison Nozzles • Monometers • Chronoflo Telemeters • Conveyoflo Meters.

Elections and Activities

The Alabama Road Builders Association has elected J. P. Moss, of Birmingham, president to succeed Alex Hancock, of Mobile, who has held the office since the organization was formed 15 years ago. Mr. Hancock was named president emeritus and an ex-officio director for life. Under the new organization plan roadbuilding contractors not only will manage the association but also will hold all the offices. Persons connected with materials and equipment industries and insurance bonding interests will be associate members. Other officers elected are: M. R. Thomason, Montgomery, vice-president; Will Dunn Jr., Birmingham, secretary-treasurer; and Clyde Mitchell, Birmingham; Everett Cobb, Montgomery; Quinn Flowers, Dothan; James A. Baird, Selma; W. A. McKee, Montgomery; and J. P. McKee, Jackson, directors.

The American Institute of Consulting Engineers has elected these officers for 1947: President: George S. Armstrong; vice-president, Leslie G. Holleran; treasurer, James Forgie; and secretary, Philip W. Henry.

The Portland, Ore., chapter of the Associated General Contractors has elected Donald Hall of the E. C. Hall Co. as president of its heavy construction division. Other officers are Marshall Newport of the Newport Construction Co., first vice-president; A. B. McEachern, General Construction Co., second vice-president; and Carl A. Schram of the Parker-Schram Co., secretary-treasurer. P. L. Crooks, Sr., Natt McDougall and J. C. Compton were made honorary directors and H. A. Dick was named the chapter's national AGC representative.

American Association of Engineers, Phoenix, Ariz., chapter has elected: President, Charles S. Beck, engineer, Arizona Edison Co., 1st vice-president A. Glen Smoot, safety engineer, Arizona State Highway Dept.; 2nd vice-president, Walter Dubree, sales engineer, secretary-treasurer, reelected J. Lee Chambers, office engineer, City Engineer's department Phoenix. Mr. Chambers has been reelected to this post yearly for 12 years. New directors for 1947 are the officers, with Karl Harris, retiring president. C. C. Tillotson, past president, and Kenneth H. Talbot, reelected.

The Mississippi Society of Professional Engineers has elected W. E. Johnson, Jackson consulting engineer, as its new president, succeeding R. L. Morrison, of Hattiesburg, with the State Highway Department. A. B. Hargie, of the University of Mississippi, was elected vice-president, and Boyce H. Biggers, Jackson, secretary-treasurer. The new executive committee is: L. L. Patterson, dean of Engineering at Mississippi State, Northern District; Joe Fountain, of Jackson, with the Mississippi Power and Light Co., Central district; and H. D. Shaw, of Gulfport, Southern district.

The North Central Texas Water & Sewage Association, has elected D. W. Robinson, chief engineer of the Community Public Service Co., president. Other officers elected were F. M. Fox, Weatherford, vice-president; W. M. Robinson, Ft. Worth, secretary-treasurer; and Mrs. Mabel Godby, Ft. Worth, assistant secretary-treasurer.

Walter Johannessen, Phoenix, of Johannessen & Girand, Engineers, was elected president of the Arizona section, American Society of Civil Engineers, at a recent convention. John Baumgartner, Tucson, U. S. Geological Survey, was named vice-president, and Leigh Gardner, Phoenix, Yost & Gardner, Engineers, secretary-treasurer.

Arizona Chapter, Associated General Contractors of America, elected president Edward O. Earl, San Xavier Construction Co., Tucson; vice-president, reelected P. W. Womack, Womack Construction Co., Phoenix; treasurer, D. W. Kelley, Arizona Sand & Rock Co., Phoenix; executive secretary, Joseph P. Condrey, Phoenix. Directors are the officers, with D. W. Kelley elected for a 3-year term, and, reelected M. O. Packard, Jr., retiring treasurer; I. G. Beall, and H. L. Royden, retiring president.

Cecil Apperson, who resigned as executive secretary of the Arizona Building Contractors Association, was named president. Other officers who will serve with him are: J. A. Brown, first vice-president; H. C. Catlin, second vice-president; John A. Murphy, executive secretary; Louis Karpe, treasurer; and H. T. Carlson, Leslie Benton, Glenn Chipperfield, J. B. Matz, L. L. Ford, Clifford L. Maddox and J. R. Porter, members of the board of directors.

At the annual meeting of the Wisconsin section of the ASCE, Edward H. Schmidtman, assistant research engineer of the Wisconsin Electric Power Co. of Milwaukee, was elected president,

Transite asbestos-cement sewer pipe cuts infiltration to a minimum... reduces sewage treatment costs. Here's how:

(1) Sleeve-type joints make up tight ... *stay* tight in service.

(2) Long 13-foot lengths result in fewer joints in the finished line.

Thus, *tighter* joints and *fewer* joints provide a double safeguard against infiltration. In turn, the load on the treatment plant is reduced... treatment costs are kept low. And, equally important, plant capacity is conserved for tomorrow's needs.

Other money-saving Transite advantages:

More Economical Installation — because Transite's light weight and long lengths make it easier to lay this pipe to line and grade.

Flatter Grades — Transite's high flow capacity (n=.010) often permits shallower trenches and correspondingly lower excavation costs... especially important in the case of rock excavation or wet trenches.

Smaller Diameter Pipe — an alternate economy to flatter grades which the designer may take advantage of when deep trenches present no serious installation problems.

High Corrosion Resistance — because of Transite's non-metallic structure that combats corrosion inside, outside and all the way through.

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HOT-POURED RUBBER SEAL

PARA-PLASTIC remains flexible all year 'round. Its elasticity is permanent in any temperature without breaking its bond with concrete.

PARA-PLASTIC maintains a positive and permanent seal in any temperature against the infiltration of water.

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WITH THE
ORIGINAL
ALL YEAR 'ROUND!

PARA-PLASTIC is the ORIGINAL hot-poured top seal for concrete expansion joints.

PARA-PLASTIC pours smoothly and uniformly at a low pouring point.

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James G. Woodburn, Professor of Hydraulic Engineering at the University of Wisconsin at Madison, 1st vice-president; O. Neil Olson, head of department of civil engineering at Marquette University, Milwaukee, 2nd vice-president; and Charles W. Yoder, structural engineer of the Portland Cement Association in Milwaukee, secretary-treasurer.

Alan J. Potter and Cesare Vappi have been re-elected president and vice-president, respectively, of the Associated General Contractors of Massachusetts. Other officers elected were William L. Bailey, treasurer, and Matthew J. Cummings, secretary. Executive committee for three years, Harold D. Billings and Elmer L. Ford. Allan E. Gifford continues as executive secretary.

Clayton L. Nairne, assistant vice-president of New Orleans Public Service, Inc., has been elected president of the Louisiana Engineering Society. He succeeds Leo J. Lassalle, dean of the college of engineering, Louisiana State University. Also elected were W. Stone Leake, New Orleans, first vice-president; H. L. Lehmann, Baton Rouge, second vice-president; and John P. Fernandez, New Orleans, secretary-treasurer. At a recent meeting Ex-Governor Sam H. Jones called on the engineers to dissipate the area's feeling of inferiority by increased development of its natural resources, industrial expansion and new building and navigation projects.

Donald Paterson, Elyria, has been elected president of the Ohio State Association of County Engineers, succeeding C. Homer Bricker, Medina County. Other officers elected were: Claude Skidmore, Union County, vice-president; Delos Nisson, Ottawa County, treasurer; and Walter F. Jacobs, Lucas County, secretary. Directors elected are: Wilbur Terry, Huron County; Art Ranney, Summit County; George Arnold, Tuscarawas County; Lot Jones, Delaware County; Howard Craig, Auglaize County; Thomas C. Freshour, Miami County; Robert Conard, Clinton County; O. C. Barklow, Scioto County; and E. N. Leonard, Gallia County.

The Home Builders Association of Dallas, Tex., has elected the following officers: R. S. Shelburne, president; Avery Mays, vice-president; J. A. Crow, secretary; W. H. Brown, treasurer. The following directors were chosen: W. W. Caruth, Jr.; H. E. Yarbrough; Charles R. Tips; R. Pelt; R. B. Carpenter; and W. Roberts. The following directors to the National Home Builders Association were chosen: E. P. Lamberth; B. Burgher; Leo Corrigan; and C. M. Brown.

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Great Falls—Hi-Line Equipment Co.
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San Antonio—Jess McNeel Machinery Co.
Plainview, Abilene, Odessa—Plains Machinery Co.
El Paso—Hardin and Coggins, Inc.
UTAH Salt Lake City—The Lang Company
VA. Richmond and Roanoke—Rish Equipment Co.
Alexandria—Phillips Machinery & Tractor Co.
WASH. Seattle—Howard-Cooper Corp.
Spokane—Intermountain Equipment Co.
W. VA. Charleston and Clarksburg—Rish Equipment Co.
WIS. Milwaukee, Eau Claire & Green Bay—Bark River Culvert & Equipment Co.

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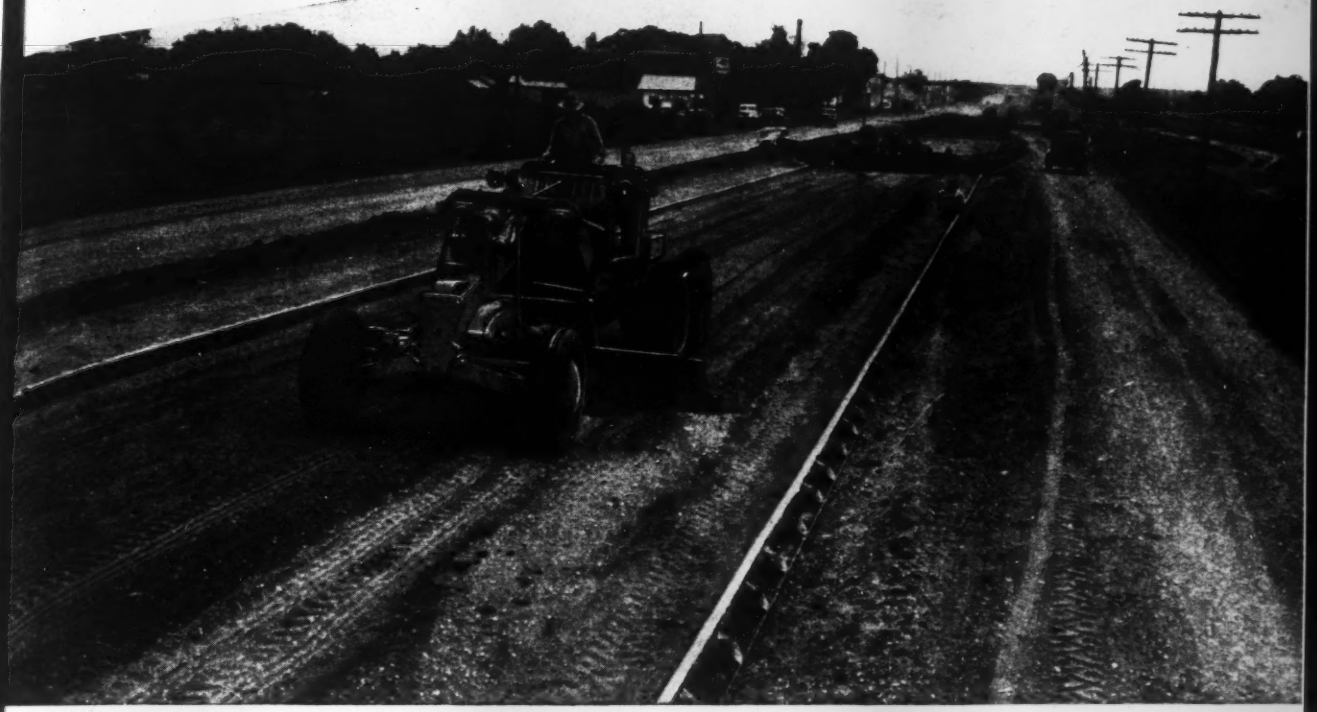
Your best buy—all ways



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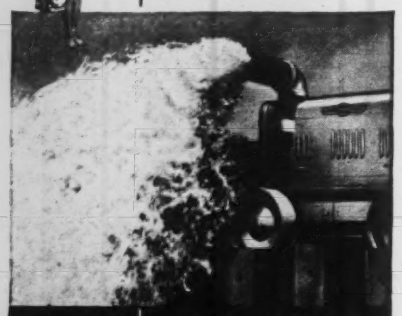

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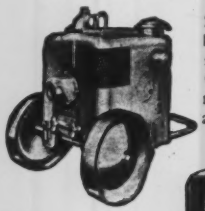
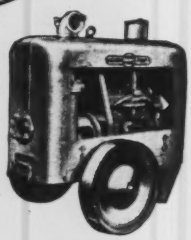
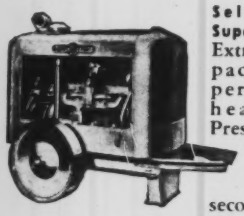


2" and 3" Heavy Duty: Most rugged small pumps built. Conservatively rated @ 10,000 and 20,000 g.p.h.



4" to 10" Portables: Compact, extra powerful units of 40,000 to 240,000 g.p.h. rating and exceptional air capacity.



Self-Priming Super-Jet Pump: Extremely compact, yet outperforms old, heavy types. Pressures to 250 lbs.; 90 h.p. engine. Only 30 seconds to prime @ 20 ft.

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Inherent priming action plus "jet" priming — doubly sure and fast . . . long-life "Lubri-Seal," accessible for inspection . . . self-cleaning shell design . . . replaceable liners or seal rings . . . Every pump tested and certified for performance.

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ENGINEERING SCHOOL NEWS

Robert S. Ingols, who has done much resarch in the field of sewage treatment, has been appointed research associate professor of sanitary chemistry at the Georgia Institute of Technology. Doctor Ingols received his B. S. from Bucknell University in 1931, an M. A. from Columbia University in 1934, a M. S. from Rutgers in 1937 and his Ph. D. from Rutgers in 1939. He goes to Tech from the University of Michigan. He was assistant chemist in the department of water and sewage research of the New Jersey Experiment Station, 1936-41; chemist in the sewage treatment plant at Hackensack, N. J., 1941-43; and visiting professor at Manhattan College and New York University, 1942-43. After leaving New Jersey, he was employed by the Florida Citrus Commission for research on citrus canning plant wastes.

F. H. Sexton, of Halifax, N. S., who was named by the Nova Scotian provincial government to establish the Nova Scotia Technical College at Halifax in 1927, and who has been president ever since, will retire on May 1. His successor is A. E. Cameron, of Halifax, formerly of London, Ont., and for the last ten years, deputy minister of mines in Nova Scotia. He is a past president of the Association of Professional Engineers of Nova Scotia. The retiring president is 67, and has been active in the introduction of vocational training schools in Nova Scotia. He was also interested in the establishment of night technical schools in various parts of the province of Nova Scotia.

Prof. Walter Gropius, dean of the Harvard University School of Architecture, addressing the Associated General Contractors of Massachusetts recently at Boston, commended the co-operative plan of the contractors and the university for on-the-job training of engineers during the summer months.

Engineering students are declining to accept well-paid jobs in foreign countries upon graduation, and prefer to work in the United States, according to Dean W. R. Woolrich of the University of Texas engineering school. He reports that an unprecedented number of good engineering jobs are available abroad, but very few war veteran students are interested. The demand for engineers in this country is six or seven times greater than the supply of new engineers, he added. Many graduates are remaining in school to get additional training, thus making the shortage more acute.

The new civil engineering building (Charles Church More Hall) at the University of Washington, Seattle, should be ready for occupancy at the beginning of the fall quarter and among the equipment will be new 60,000, 125,000 and 300,000-lb. universal machines together with the 1,500,000-lb. hydraulic testing machine (*ENR* Feb. 13-vol. p. 250). The first three machines have already been received and are being used in the portion of the building already completed. The largest machine should deliver 2,000,000 lbs. in compression and 1,500,000 lbs. in tension and has 120 inches between screws. The department of civil engineering was represented at the acceptance tests recently conducted at the Baldwin Locomotive plant in Philadelphia, Pa., by Prof. F. B. Farquharson, who is in charge of the structural research laboratory of the department.

Appointment of Allen S. Janssen as dean of the college of engineering at the University of Idaho has been recommended to the governor by the Idaho Society of Engineers. Janssen has been acting dean since J. E. Buchanan was promoted to the presidency of the university.

A record enrollment of 5,620 students at the Georgia School of Technology for the winter quarter has been made possible, despite the lack of adequate classrooms and laboratories, through the continual use of all facilities from 7:00 A.M. to 10:00 P.M. every day except Saturday, when classes end at 5:00 P.M., it is reported by President Blake R. Van Leer. Undergraduate and graduate students number 4,485, with the balance being enrolled in the day and night sessions of the extension division. Colonel Van Leer further reports that during 1946 the school was forced to reject more than 5,000 applicants from out of state, but accepted all applicants from Georgia except 175, of whom 125 have been accepted for the spring quarter now starting, and 50 were rejected because of failure in meeting entrance requirements. In order to take care of the additional load, a group of 21 full-time and part-time instructors and consultants have added to the faculty recently.

Manufacturers' Activities

Appointment of CHARLES O. ROOME as manager of the St. Louis district heads a series of field personnel changes in the mechanical goods division of Goodyear Tire & Rubber Co., Akron, Ohio. John E. Ragan, manager of the St. Louis district since 1935, has transferred to Atlanta as district manager. Philip C. Antoine goes to New Orleans, transferring from Memphis. Richard P. Goodenough succeeds Mr. Antoine at Memphis. Charles H. Murtaugh is at South Bend, Ind., replacing Gerald W. Zolman, who returns to Chicago. At Charlotte, N. C., Carl Baker becomes field representative. Robert J. Ario will transfer to Cleveland from Orlando, Fla.; William R. Burtle succeeds Mr. Ario in Florida, transferring from Philadelphia. His successor in Philadelphia is Robert C. Alexander.

FREDERICK I. HAUSMAN, formerly treasurer, has been elected president of the Hausman Steel Co., Toledo. Elected vice presidents were Roy G. Walton, in charge of field operations and concrete form work, and Ben Hausman, in charge of material sales in Toledo. Myer Hausman continues as vice president in charge of the Columbus, O., office and warehouse. James S. Hausman, formerly vice president, was elected treasurer; and Lester E. Jones, secretary.

The appointment of ELTON E. PEAVY as Southwest district manager for the sale of Dresser products to the water industry has been announced. He will cover the southwest territory including Texas, Louisiana, Oklahoma, Arkansas, Mississippi and New Mexico.

Mr. Peavy succeeds H. R. Shidel who will direct the sale of Dresser welding fittings in this area and supervise the Houston, Tex., warehouse.

FISCHER & PORTER CO., manufacturers of variable area type flow rate instruments, heretofore called "Rotameters" has recently announced its intention to change the name of its products to "Flowrators." The first use of the old term "Rotameter" appears to have been made about 40 years ago by an early continental manufacturer of transparent-tapered-tube-variable-area-flow-rate-indicators, and a good many controversies have punctuated the history of this term. It is hoped that the trade mark name "Flowrator" will

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AMERICAN BRAKE SHOE CO., New York, N. Y. announces the appointment of Homer Parsons as assistant director exports. Mr. Parsons, who has had 19 years' experience in the export field, has been a sales representative for Brake Shoe's export department since August 1945.

PERMANENTE CEMENT CO., operator of the world's largest cement plant at Permanente, Calif., has announced that its new $500,000 plant in Seattle, Wash., has been put into operation. Storage capacity of 80,000 barrels will provide additional cement for use in western Washington, Canada and Alaska. The new division will be under the direction of E. H. Kendall.

Strike-bound since October 7, the Commercial Body Building Division of the SMITH COMMERCIAL BODY WORKS, Fargo, N. D. was recently discontinued, according to Donald A. Smith, president. This move is coincident with expansion of a department devoted to selling municipal equipment and supplies, plus increased emphasis on the sale of general construction equipment and truck and bus equipment. New name of the organization is Smith, Incorporated.

DAVID W. LEHTI, vice president of the Link-Belt Speeder Corp., since 1942, has been named president, with offices in Chicago and Cedar Rapids. He succeeds Troy M. Deal. Mr. Lehti first became associated with the company as distributor in 1925.

Announcement was made on the sale of FORSS PNEUMATIC TOOL CO., Aurora, Ill., to Skilsaw, Inc., of Chicago—manufacturer of portable electric tools. The Aurora plant, which will be known as "Pneumatic Division of Skilsaw, Inc.," will remain in Aurora and plans are underway for its expansion. The Forss personnel, including two of the former owners, F. P. Forss and J. W. Forss, will be retained by Skilsaw, Inc.

CURTIS WRIGHT INDUSTRIES, manufacturers of trailer coaches, have just announced the acquisition of a 5¾-acre tract in Hillgrove, adjoining Puente, Calif., where the company's present main plant and offices are located. A new, modern factory and warehouse building will be constructed on the site. In addition to the new building, the size of the present plant is being doubled.

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ALABAMA—BIRMINGHAM: Aronov Auto Supply Co., 420 S. 21st St. MOBILE: Betbeze, 610 St. Anthony. MONTGOMERY: Jake Aronov Auto Parts & Tire Co., Cor. Bell & Washington Sts.

ARKANSAS—LITTLE ROCK: G. L. Turner, Inc., 320 E. Markham St. MEMPHIS, TENN.: Dealers Truckstell Sales, Inc., 365 S. Parkway, W.

CALIFORNIA—LOS ANGELES: General Truck Equipment Co., 746 S. Central. OAKLAND: A. Pasteris Co., 2200 Wood St.

COLORADO—DENVER: The Colorado Builders Supply Co., 324 S. Broadway.

FLORIDA—JACKSONVILLE: Clark Equipment Inc., 1820 Main St.

GEORGIA—ATLANTA (COLLEGE PARK): Carley Trailer & Equipment Co.

IDAHO—TWIN FALLS: Twin Falls Equipment Co., 251 Main Ave. W.

ILLINOIS—CHICAGO: Voltz Bros., Inc., 2520 Indiana Ave. PEORIA: A. W. Moore, 2710 S. Adams St. BETTENDORF, IOWA: Standard Wholesale Co., 1525 State St. ST. LOUIS, MO.: Truck Equipment Co., 511 N. Channing Ave. EVANSVILLE, IND.: Hercules Body Co., Inc.

INDIANA—EVANSVILLE: Hercules Body Co., Inc.; FORT WAYNE: Peerless Manufacturing Co., 4227 Bluffton Rd. INDIANAPOLIS: John Guedelhoefer Wagon Co., Inc., Kentucky Ave. at Georgia Ave. LOUISVILLE, KY.: J. Edinger & Son, 1010 State Ave. CINCINNATI, O.: The Bode-Finn Co., 2650 Spring Grove Ave.

IOWA—BETTENDORF: Standard Wholesale Co., 1525 State St. CEDAR RAPIDS: E. Cohn & Sons, Inc. SIOUX CITY: Barton-Stephens & Co., 1909 E. Fourth St.

KENTUCKY—LOUISVILLE: J. Edinger & Son, 1010 State Ave. HUNTINGTON, W. VA.: Huntington Truck Equipment Co., 3004 Third Ave. EVANSVILLE, IND.: Hercules Body Company, Inc. CINCINNATI, O.: The Bode-Finn Co., 2650 Spring Grove Ave.

LOUISIANA—NEW ORLEANS: Magnolia Equipment & Security Corp., 900 Jefferson Hwy. SHREVEPORT: Dealers Truck Equipment Co., Inc., 1561 Texas Ave. MEMPHIS, TENN.: Dealers Truckstell Sales, Inc., 365 S. Parkway, W.

MARYLAND—BALTIMORE: United Truck Equipment Co., 1242 S. Paca St.

MASSACHUSETTS—CAMBRIDGE: Hercules-Campbell Body Co., 130 Brookline St.

MICHIGAN—DETROIT: Waggy-Hoffman Equipment Co., 14089 Schaefer Hwy. CHICAGO, ILL.: Stahmer Supply Co., 135 S. LaSalle St.

MINNESOTA—ST. PAUL: General Truck & Equipment Co., 2535 University Ave.

MISSISSIPPI—MEMPHIS, TENN.: Dealers Truckstell Sales, Inc., 365 S. Parkway, W. MOBILE, ALA.: Betbeze, 610 St. Anthony.

MISSOURI—KANSAS CITY: American Body & Equipment Co., 1411 Charlotte St. ST. LOUIS: Truck Equipment Co., 511 N. Channing Ave.

MONTANA—BILLINGS: Western Construction Equip. Co., 505 N. 24th St. MISSOULA: Western Construction Equip. Co., 218 W. Pine St.

NEBRASKA—LINCOLN: Highway Equip. & Supply Co., 21st & N Sts. SCOTTSBLUFF: Colorado Builders Supply Co., 602 W. 27th St.

NEW MEXICO—ALBUQUERQUE: The Harry Cornelius Co., 1510 N. Second St.

NEW YORK—BUFFALO: Truckstell-Wilcox, Inc., 224 W. Utica St. TARRYTOWN: Hercules-Campbell Body Co., Inc. WATERLOO: Hercules-Campbell Body Co.

NORTH CAROLINA—RALEIGH: J. B. Hunt & Sons, 323-25 W. Martin St. SPRUCE PINE: Mitchell Distributing Co.

NORTH DAKOTA—ST. PAUL, MINN.: General Truck & Equip. Co., 2535 University Ave.

OHIO—CANTON: Ewing Brothers, 929-41 Cleveland Ave., N. W. CINCINNATI: The Bode-Finn Company, 2650 Spring Grove Ave. CLEVELAND: The Trailmobile Company, 1808 E. 22nd St. COLUMBUS: Hercules Body Sales Co., 580 Hamlet St. UHRICHSVILLE: Wells Body Co., 112-20 Lake St. YOUNGSTOWN: O Dea Truck Body Sales, 2035 Ohio Ave. HUNTINGTON, W. VA.: Huntington Truck Equip. Co., 919 Sixth Ave. DETROIT, MICH.: Waggy-Hoffman Equipment Co., 14089 Schaefer Highway.

OKLAHOMA—LAWTON: Tompkins Auto Salvage Co., 917 S. Second St. OKLAHOMA CITY: 1801 N. E. Ninth St. TULSA: The Diesel Power Co., 4th & Elgin Sts.

OREGON—PORTLAND: Newell Truck Equipment Co., 316 N. Russell St.

PENNSYLVANIA—ALTOONA: Brumbaugh Body Co., 100 Plank Road. ERIE: The Trailmobile Co., 1223 Walnut St. LEBANON: M. A. Brightbill Body Works, E. Cumberland St. at 7th Ave. PHILADELPHIA: Eastern Body Co., 31st & Fletcher Sts. PITTSBURGH: Hercules-Pittsburgh Body Co., 1717 Mary St., S. S.

SOUTH CAROLINA—COLUMBIA: South Carolina Equipment Co., P. O. Box 295.

SOUTH DAKOTA—ST. PAUL, MINN.: General Truck & Equip. Co., 2535 University Ave.

TENNESSEE—CHATTANOOGA: Ted Nelson Service & CHR Alignment Co., 416-18 Market St. KNOXVILLE: Knoxville Structural Steel Co., P. O. Box 1512. MEMPHIS: Dealers Truckstell Sales, Inc., 365 S. Parkway, W. NASHVILLE: Carter, Inc., 650 Murfreesboro Rd.

TEXAS—DALLAS: Truck Equipment Co., 2409-11 Commerce. FORT WORTH: Truck Equip. Co. HOUSTON: McArthur Welding & Press Co., 3525 Clinton Dr. SAN ANTONIO: Patton Machinery Co., 1318 N. Alamo St. CORPUS CHRISTI: Truck Equip. Co., 1501 Port Ave.

UTAH—SALT LAKE CITY: Hercules Body Sales Co.

VIRGINIA—NORFOLK: A. S. Drumwright & Co., 1921 Brambleton Ave. RICHMOND: Crenshaw Equipment Co., Inc., 304 E. Main St.

WASHINGTON—SEATTLE: Allied Trailer & Equip. Co., 1331 Third Ave.

WEST VIRGINIA—BLUEFIELD: Truck Equip. Engineering Co., P. O. Box 387. CHARLESTON: West Virginia Tractor & Equip. Co., P. O. Box 4273. CLARKSBURG: West Virginia Tractor & Equip. Co., 100 Wood St. HUNTINGTON: Huntington Truck Equip. Co., 919 Sixth Ave.

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Manufacturers' Publications

Tandem Rollers — (12-p. catalog) Gives detailed construction views and data on line of variable weight tandem rollers, as well as complete specifications.—*Galion Iron Works & Mfg. Co., Galion, Ohio.*

Wiring—(12-p. catalog revision) Describes and illustrates 4x4 Wirewa, enclosed metal duct for housing and protecting electric wires and cables. Photographs and schematic drawings of all component parts of wireway are included. — *National Electric Products Corp., Chamber of Commerce Bldg., Pittsburgh* 19, *Pa.*

Axonometric Drawing—(20-p. illustrated booklet) Explains fundamentals of three-dimensional illustration and its advantages. Ten cents a copy.—*Instrumaster Industries, Inc., Arch St., Greenwich, Conn.*

Wheel Tractor—(4-p. bulletin) Lists features of Model B wheel tractor with industrial mower, illustrated by action shots, close-up, cutaway photos. Specifications listed in detail.—*Allis Chalmers Mfg. Co., Tractor Division, Milwaukee* 1, *Wis.*

Portable Plant—(8-p. bulletin) Describes new, small, portable crushing and screening plant called the Pitmaster Straightline. — *Iowa Mfg. Co., Cedar Rapids, Iowa.*

Panel Heating — (Manual) Entitled "Automatic Control of Radiant Panel Heating," book contains diagrams, charts and photographs, together with information on use of graphs for determining required performance of heating installation under control.—*Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.*

Hose Coupling — (20-p. pocket-size handbook) Is planned to aid user of hose and hose couplings in reducing operating costs and increasing efficiency of his equipment. Valuable hints and information on the care of hose, selection and installation of correct hose couplings for various types of equipment as well as other useful data, are presented in clear, easy-to-use form.—*Hose Accessories Co., 2702F N. 17th St., Philadelphia* 32, *Pa.*

Jacks—(4-p. bulletin) Describes Simplex Util-A-Tool and pictures it in many

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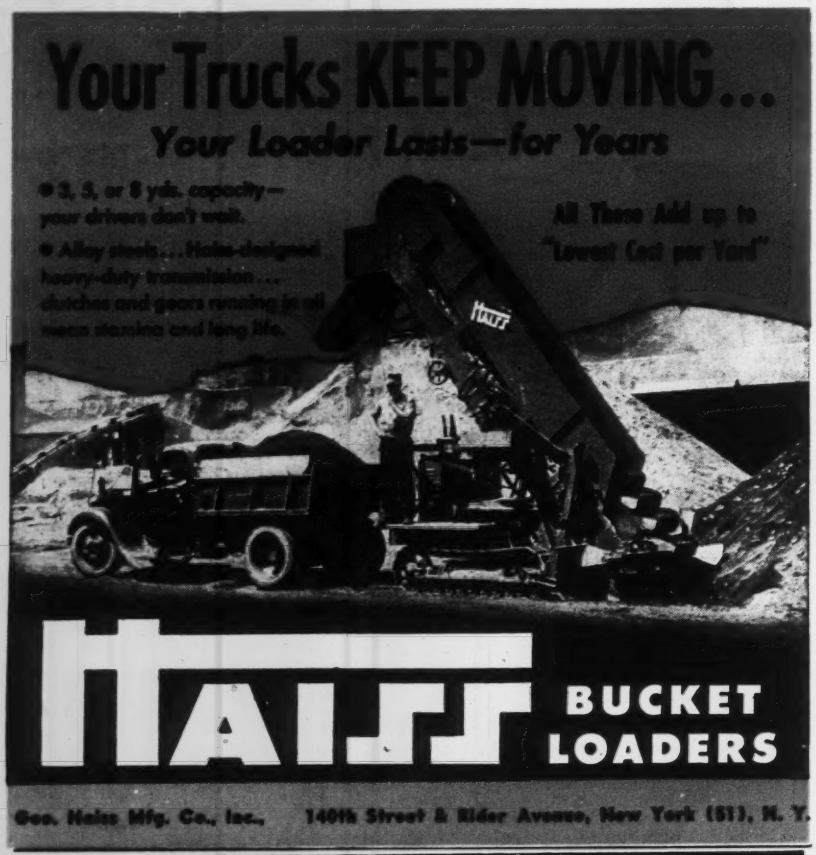
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operations. — *Templeton, Kenly Co., 1020 S. Central Ave., Chicago 44, Ill.*

Sand Blast Hose—(Catalog leaflet) Describes construction of product and gives data on sizes, weight per hundred feet and outside diameters.—*The B. F. Goodrich Co., Akron, Ohio.*

Eye Protection—(8-p. bulletin) Describes in detail chippers' goggles with protective lenses, chemical goggles, open-frame Ful-Vue spectacles, spectacles with side screens and leather side shields, dust goggles, dreadnaut goggles, welders' goggles, foundry and melters' goggles, acetate spectacles, gas goggles, wire screen goggles, and specially designed goggles for workers who must also wear corrective glasses.—*Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.*

Water Meter — (8-p. bulletin) Provides detailed description of arctic-type Pittsburgh disk meter. Full-scale cutaway photos, reproduced in natural colors with identifying captions keyed to major parts, present construction features graphically. Subassembly features are described through isometric and sectional drawings with accompanying descriptive text. Technical data, dimensions and list prices are tabulated. Three-page section is devoted to repair parts. Exploded views in which all operating parts are shown exactly as they are assembled in meter case simplify ordering of replacement units and serve as assembly guide for repair man. Meters in sizes 5/8-, 3/4-, and 1-in. are described.—*Pittsburgh Equitable Meter Division, Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.*

Flooring—Stresses reduction of floor maintenance costs by major companies through the use of Emeri-Crete flooring and gives test data on installations discussed. Included is list of industries, ranging from aircraft to textile, where Emeri-Crete has solved difficult flooring problems.—*Walter Maguire Co., Inc., 330 W. 42nd St., New York 18, N. Y.*

Electric Cable Hoists—(8-p., three-color bulletin) Is profusely illustrated with cross sections of Bobcat hoists and other engineers' parts, tables, etc.—*Lisbon Hoist & Crane Co., Lisbon, Ohio.*

Hydraulic Control Hose—(Catalog leaflet) Discusses construction features of product and method of manufacturing. Page is devoted to correct method for figuring correct length of hose for various bending radii of various sizes of hydraulic control hose.—*The B. F. Goodrich Co., Akron, Ohio.*